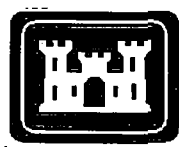


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US Army Corps  
of Engineers  
Omaha District

APPROVED

TECHNICAL SUPPORT SECTION  
DOCUMENT

HIMCO DUMP SUPERFUND SITE

ELKHART, INDIANA

FINAL WORK PLAN FOR  
PREDESIGN FIELD ACTIVITIES

APPROVED

Prepared for

USEPA REGION V  
CHICAGO, IL

8/4/95

JULY, 1995

**FINAL**  
**ADDENDUM**  
**TO THE**  
**FINAL QUALITY ASSURANCE PROJECT PLAN**  
**FOR**  
**REMEDIAL DESIGN/REMEDIAL ACTION FIELD ACTIVITIES**  
**AT THE**  
**HIMCO DUMP SUPERFUND SITE**  
**ELKHART, INDIANA**

July 1995

Prepared by: Greg E. Ruechel  
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Date: 7/24/95

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Date: 7/24/95

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Date: 7/24/95

Approved by: Rick Grabowski  
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Project Geologist, U.S. Army Corps of Engineers, Omaha District

Date: 7/24/95

Approved by: \_\_\_\_\_  
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Remedial Project Manager, U.S. EPA Region V

Date: \_\_\_\_\_

Approved by: Willie H. Harris  
Willie H. Harris  
Regional Quality Assurance Manager, U.S. EPA Region V

Date: 8/4/95



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 5  
77 WEST JACKSON BOULEVARD  
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

SQ-14J

MEMORANDUM

DATE: AUG 04 1995

SUBJECT: Approval of the First Revision Quality Assurance  
Project Plan (QAPP) for the Fund-Lead Remedial  
Design/Remedial Action (RD/RA) Activities at the HIMCO  
Dump Superfund Site in Elkhart, Indiana

FROM: *Willie H. Harris*  
Willie H. Harris  
Regional Quality Assurance Manager

TO: Thomas L. Poy, Chief  
Section 3, Remedial Response Section

ATTENTION: William Turpin Ballard, Remedial Project Manager  
(RPM)

I am granting approval of the first revision QAPP for the  
Fund-Lead RD/RA activities at the HIMCO Dump Superfund Site in  
Elkhart, Indiana. The subject QAPP was received by the Quality  
Assurance Section (QAS) on July 31, 1995 (QAS Log-in SF # 2206).  
Attached to this memorandum is the signed Signature page. Please  
have the RPM provide final sign-off and return a copy to QAS  
within 2 weeks for our records.

Attachment

cc: Steve Ostrodka, HST-6J



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(RUST Engineering)**

**APPENDIX C - HEALTH AND SAFETY PLAN (HASP)  
(RUST Engineering)**

# **HIMCO DUMP SUPERFUND SITE**

## **FINAL REMEDIAL DESIGN WORKPLAN**

### **1.0. INTRODUCTION.**

**1.1. Purpose.** In April 1995, U.S. Environmental Protection Agency (USEPA) Region V requested that the U.S. Army Corps of Engineers (USACE), Omaha District to perform Remedial Design activities for the Himco Dump Superfund Site, Elkhart, IN. The Omaha District's project goals are to complete the design in accordance with USEPA Interagency Agreement with attached Scope of Services and Record of Decision to furnish the required documents to the USEPA for future remedial action at this site. The Omaha District prepared this Work Plan to assure the selected remedy can be implemented. The major components of the selected remedy include:

- Construction of a composite barrier, solid waste landfill cover (cap);
- Use of institutional controls on landfill property to limit land and groundwater use;
- Installation of an active landfill gas collection system including a vapor phase carbon system to treat the off-gas from the landfill. An enclosed ground flare system will be implemented if landfill gas characterization studies indicate VOC emission exceed ARARs (Indiana Administrative Code 326 IAC); and
- Monitoring of groundwater to ensure effectiveness of the remedial action and to evaluate the need for future groundwater treatment.

**1.2. Site Description.** The Himco Dump Superfund Site is a 58 acre site adjacent to Elkhart, IN. The Landfill was privately operated by Himco Waste Away Service, Inc. from 1960 to September 1976 accepting primarily calcium sulfate from Miles Laboratories. Other wastes accepted at the landfill included demolition/construction debris, household refuse, industrial wastes, and hospital wastes. In 1976 the landfill stopped receiving waste. The landfill was then covered with approximately one foot of sandy soil.

**2.0. PREDESIGN STUDIES.** Pre-Design will involve the gathering of data to supplement the available technical data, prior to preparing the design documents for a landfill cover system including gas collection and ground water monitoring. The existing data base available from the Remedial Investigation (RI), Feasibility Study (FS), a site visit, and information supplied by the RPM was reviewed prior to scoping this Work Plan. The existing project data is summarized below: The need for additional studies are subsequently identified.

### **2.1. Field Surveys and Record Searches.**

**2.1.1. Aerial Photography.** EPA provided historic aerial photographs to the Omaha District to preliminarily define the nature and extent of the Himco Dump Landfill. The photographs can also be used to assess wetlands, public infrastructure and land use. No additional study is required.

**2.1.2. Topographic Surveys.** EPA also provided topographic surveys for the Himco site. During February 1991, Lang, Feeney and Associates, Inc., Land Surveying - Construction Engineering, South Bend, Indiana, prepared these surveys as a subcontract to Donohue & Associates. The surveys were done on 3 1/2 inch disk in Autocad V.10 format. During June 1995, the Omaha District converted the drawings to Intergraph format. The surveys are adequate to complete the design of the landfill cover. Additional surveys may be required depending upon the location of on-site borrow/wetlands development. These surveys would be done by the Omaha District using electronic distance machine (EDM) and could be completed in several days.

**2.1.3. Horizontal and Vertical Control.** Lang, Feeney and Associates established adequate horizontal and vertical for topographic surveying & mapping. Horizontal control was based upon State of Indiana horizontal grid coordinates. Vertical control was set relative to mean sea level. No additional study is required.

**2.1.4. Monitoring Baseline Surveys.** The existing monitoring wells, trench locations and borings have all been surveyed to define the horizontal coordinates and vertical elevations. EPA supplied a copy of the field notes to the Omaha District. The well locations and elevations are identified on the CADD drawings. The new monitoring wells that will be installed as a component of this Work Plan will have to be surveyed in for both horizontal location and vertical elevation by the Omaha District using electronic distance equipment.

**2.1.5. Utilities.** Utility locations must be defined in order to conduct predesign and remedial action activities. All on-site above and below ground utilities need to be identified, located and subsequently shown on the project drawings. The existing surveys only delineates utility features visible to the camera such as power poles. A utility search will be completed by conducting both an on-site inspection and by contacting the utility companies. The location of on-site utilities will include horizontal alignment, depth or height, types, sizes, and utility company contacts and telephone numbers. If required the Omaha District will pursue digging permits from the utility companies for the predesign activities.

**2.1.6. Boundary Survey and Property Search.** Boundary surveys are required in order to determine fence alignments, prepare right-of-way drawings and obtain rights-of-entry for both predesign and remedial action activities. Lang Feeney and Associates, also conducted a boundary survey and a property search which identified property owners for all affected and adjacent parcels of land. EPA supplied this material to the Omaha District on Autocad. No additional study is required.

## **2.2. Geological Investigations.**

**2.2.1. Landfill Limits.** It is necessary to define the limits of the landfill in order to place a final cover over the contaminated area. The landfill limits at the HIMCO site are currently adequately defined by both the physiography and topography of the terrain.



In addition, the trenching effort physically verified the landfill contents and limits. No additional study is required.

**2.2.2. Material Excavatability.** A methane gas barrier and collection trench will be assessed to protect the residences located to the south of the landfill being along Fort Wayne Road (County Road # 10). When a project feature such as a collection trench is required, then the excavatability of the subject material should be evaluated. The boring and trench data was reviewed indicating that both the native soils being sands and the refuse material can be readily excavated. No additional study is required.

### **2.3. Landfill Gas Investigation.**

#### **2.3.1. Gas Generation - Quantity, Composition, and Location.**

**2.3.1.1. Description of Services.** The Omaha District will use A-E (Quadrell) to conduct a passive soil gas survey at HIMCO Superfund Site. The objective is to verify the presence and determine the production of methane within the landfill. The A-E will conduct the soil gas sampling and analysis during pre-design. Sampling and analysis procedures are described in the FSP.

Upon completion of all field work, the gas sample concentrations shall be used to calculate the annualized methane generation rate at each sampling location and over the entire landfill. This information will then be utilized in designing an active landfill gas collection system. This gas collection will require all gas to be conveyed to a central location and treated through a granular, activated carbon treatment system for odor control, and potentially a flare system to burn off the methane gas if the methane rate exceeds RCRA or State of Indiana standards.

### **2.3.2. Offsite Gas Monitoring.**

**2.3.2.1. Gas Monitoring Criteria.** A major constituent of Landfill Gas (LFG) is Methane ( $\text{CH}_4$ ).  $\text{CH}_4$  is lighter than air, colorless and odorless. LFG is flammable due to the presence of  $\text{CH}_4$  and can be asphyxiant if present in high concentrations without  $\text{O}_2$ .  $\text{CH}_4$  is explosive at about 5 to 15 percent by volume in air. The presence of  $\text{CO}_2$  affects these ranges although little significant change occurs in the lower limit of the range. Offsite explosive gas concentrations may not exceed 25 percent the lower explosive limit (1.25% methane). To identify the offsite release of methane, gas monitoring probes shall be installed around the entire perimeter of the landfill. THE GAS MONITORING PROBES WILL BE PLACED AS A COMPONENT OF THE REMEDIAL ACTION AND NOT DURING PRE-DESIGN ACTIVITIES. During the first year of operation the gas monitoring probes will be monitored on a weekly basis for the first 2 months, and biweekly for the remaining 10 months, to ensure that the gas collection system is performing as designed. Methane gas concentrations will also be monitored on a weekly basis during construction, and prior to the start up of a blower/flare system.

**2.3.2.2. Gas Monitoring Probe Locations.** The gas monitoring probes will be placed during remedial action. Thirty five monitoring probes will be installed around the perimeter of the landfill to verify the effectiveness of the gas collection system. The probes will be placed at approximately 100 foot centers near the residences along the southwestern perimeter of the landfill, and at 200 foot centers along the remainder of the landfill perimeter.

**2.3.2.3. Gas Monitoring Probe Design.** The gas monitoring probes are a 6 inch borehole, 15 feet in depth, with a 1 inch internal diameter perforated PVC screen. The top cap of each monitoring probe will be fitted with a 1/4 inch diameter flexible tubing and clamp, to allow extraction of the gas to be monitored. Each monitoring probe will have

a protective steel casing, and have 3 concrete filled pipes spaced around the probe for protection.

**2.4. Borrow Source Investigation.** The Omaha District will perform borrow site investigations to determine if adequate borrow material is available for the various layers of the cover. The availability of both on-site and off-site sources will be evaluated. On-site borrow will normally result in substantial cost savings over off-site materials. Off-site materials must be purchased by the Contractor and hauled to the project. This stresses access roads and may be a concern to the public due to increased traffic volume. If on-site borrow is developed, the excavated area will be reclaimed as a wetland area.

**2.4.1. On-site Borrow.** Obtaining adequate on-site borrow material in sufficient quantity to construct the landfill cover system is the preferred borrow alternative. The borrow materials would be obtained from along the north side of the landfill, upgradient of the landfill in non-contaminated areas. The EPA, Indiana Department of Environmental Management (IDEM), and U.S. Army Corps of Engineers will conduct an on-site inspection in order to locate a potential borrow/wetland area. The Omaha District will solicit borrow source information from the PRP and adjacent landowners. After a borrow site is located, a trenching effort would be conducted in order to characterize the nature and extent of borrow material and to identify ground water levels. A Health and Safety Plan would not be required for any trenching effort since all activities would be in non-contaminated areas. The borrow area would then be shaped, graded, and vegetated to create wetland areas that would benefit both waterfowl and the fishery. Deep and shallow water habitat could be combined with nesting islands and an irregular shoreline. Wetland vegetation species could also be introduced.

**2.4.2. Laboratory Testing.** Omaha District field-crews will collect soil samples from the proposed on-site borrow areas for laboratory testing. The tests shall include grain size analysis (mechanical and hydrometer)(ASTM D 421 and 422), moisture content (ASTM D 2216) which shall be run on all samples, Atterburg limits (ASTM D 4318), and

permeability testing if the soil is cohesive. In addition, a chemical analytical testing will be conducted to verify that the proposed borrow area is not contaminated. One sample for every 10,000 cubic yards will be tested using the following EPA test methods: TCL VOC (8260A), TCL SVOC (8270B), PEST/PCBs (8080A), and RCRA Metals (7060A/7740/7421/3050A/6010/7471A).

**2.5. Groundwater Investigation.** The Omaha District will perform a groundwater investigation at the Himco Dump Superfund Site to include: a survey of existing monitoring and residential wells to determine their condition and suitability for use in a long-term monitoring program, installation of additional monitoring wells both upgradient and downgradient to supplement existing monitoring wells and provide additional chemical and hydrogeologic data, short-term (periodic) monitoring of the system during the design period. The major objective of this investigation is to determine whether groundwater quality in the vicinity of the Himco Site has deteriorated since the time of the last RI sampling, which was performed in September, 1991. Chemical data generated from this proposed study shall be used in conjunction with information from the previous RI investigations to fully characterize groundwater conditions. This groundwater investigation is also discussed in Section 3.0, and in detail in the FSP.

**2.6. Landfill Composition.** During the RI/FS, thirteen test pits were excavated at the HIMCO Dump to delineate the extent of construction debris and collect leachate samples from select test pits. The results of that trenching effort is presented in Volume 3 of the Draft Remedial Investigation Report, Appendix C - Technical Memorandum Number 24. The Omaha District will use the information on landfill depth, composition, settlement analysis, stability analysis, ability to regrade refuse to design the cover, vent and monitoring systems. No additional study is required.

**2.7. Leachate.** As reported in the above referenced trenching effort, leachate does exist within the landfill refuse. This leachate does not appear to be migrating laterally where it is exiting from the surface of the existing landfill. The perimeter of the landfill will be

inspected to locate leachate seepage and exit areas. If any seeps are found they will be mapped and drainage layers will be incorporated into the remedial design to collect the leachate.

**2.8. Foundation Soils.** Existing RI soil boring data will be used to determine settlement and stability of the landfill material for the future cover system. The foundation soils will be characterized by determining material types and extent, water content, density, depth to ground water. No additional study is required.

**2.9. Rights-of-Entry Requirements.** During June 1995, EPA tasked the Omaha District to acquire real estate (RE) rights of entry from two private owners and along a bordering county road. EPA will acquire PRP RE access. All RE rights of entry are required prior to the start of predesign fieldwork. The Omaha District plans to conduct the pre-design field activities (Table 2) and monitoring well installation (Field Sampling Plan) from August 1, 1995 to September 27, 1995. In addition, the real estate access is required to in order to conduct several rounds of ground water sampling.

**3.0. FIELD SAMPLING PLAN (FSP).** The Final FSP for the Pre-design Fieldwork is attached in Appendix A.

**4.0. QUALITY ASSURANCE PROJECT PLAN (QAPP) ADDENDUM.** The Final QAPP Addendum for the Pre-design Fieldwork is in Appendix B. The addendum was prepared by RUST Engineering previously known as SEC Donohue. The QAPP is an addendum to the 1990 RI/FS QAPP.

**5.0. HEALTH AND SAFETY PLAN (HASP) ADDENDUM.** The Final HASP Addendum for the Pre-design Fieldwork is in Appendix C. The addendum was prepared by RUST Engineering previously known as SEC Donohue. The HASP is an addendum to the 1990 RI/FS HASP.

**6.0. PERMITTING REQUIREMENTS.** The need to obtain specific permits is waived by statute under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Section (e) (1), 42 United States Code 9621 (e) (1), as amended. However, the project will be designed and executed to comply with all identified applicable or relevant and appropriate (ARARS) federal, state and local standards, requirements, and criteria cited below. As stated in the Record of Decision (page 21), the more stringent of either state or federal requirements will be applied unless a waiver is invoked pursuant to section 121(d)(4)(B) of CERCLA. After reviewing the potential ARARS a waiver is not expected. Table 1 is a summary of the project ARARS. This table was prepared by referencing the following documents: The HIMCO Dump Site Record of Decision, the Statement of Work, the Final Feasibility Study Report and the Corps of Engineers guidance document titled CHECKLIST FOR HAZARDOUS WASTE LANDFILL COVER DESIGN dated October 1994. Table 1 also includes narrative which explains how the Corps of Engineers will approach ARAR compliance during the design and implementation of the project.

<b>TABLE 1</b> <b>FINAL APPLICABLE OR RELEVANT</b> <b>AND APPROPRIATE STANDARDS</b>		
<b>CLEAN-UP CRITERIA</b>		
<b>STANDARD</b>	<b>CITATIONS</b>	<b>DESCRIPTION</b>
Safe Drinking Water Act	42 USC 300g	
• National Primary Drinking Water Standards	40 CFR Part 141	Establishes health based standards for public water systems (maximum containment levels)

<b>ECOLOGICAL RESOURCE ISSUES</b>		
<b>STANDARD</b>	<b>CITATIONS</b>	<b>DESCRIPTION</b>
Wetlands Protection	Through the State of Indiana water Quality Surveillance Standards Branch and the Indiana DNR Division of Water Requirements	State ARAR as identified by the State of Indiana in the ROD
Protection of Wetlands	40 CFR 6.302(a), Appendix A & Executive Order 11990	Requires federal agencies to avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands in a practicable alternative exists.
Executive Order on Floodplains Management	Executive Order 11988 40 CFR 6.302(b) & Appendix A	Requires federal agencies to evaluate the potential effects of actions they may take in a floodplain to avoid, to the extent possible, the adverse impacts associated with direct and indirect development of the floodplain.
<b>DESIGN GUIDANCE</b>		
<b>STANDARD</b>	<b>CITATIONS</b>	<b>DESCRIPTION</b>
Solid Waste Disposal Act	42 USC 6901-6987	
Resource Conservation and Recovery Act (RCRA)**	Pub. L. 94-580	Enacted as an amendment to the Solid Waste Disposal Act.
● Closure and Post Closure	40 CFR Part 264 - Subpart G	Establishes criteria for closure performance standards, must control, minimize or eliminate escape of hazardous waste to the extent necessary to protect human health and the environment.
● Surface Impoundments	40 CFR Part 264 - Subpart K	Establishes liner standards, monitoring and inspection requirements.

● Waste Piles	40 CFR Part 264 - Subpart L	Establishes standards for precipitation runoff or leachate prevention, design and operation criteria, and monitoring and inspection.
● Landfills	40 CFR Part 264 - Subpart N	Establishes requirements for design, operation, monitoring, closure and post closure care.
Indiana Solid Waste Landfill Cover Standards	Title 329 IAC Articles 2-4, 2-14, 2-15 and 3.1-9	State ARAR as identified by the State of Indiana in the ROD
Indiana Solid and Hazardous Waste Management	Title 329 IAC Article 2-11	State ARAR as identified by the State of Indiana in the ROD
<p><b>**The RCRA requirements described above was described in the ROD as not being applicable because the hazardous waste in the HIMCO landfill was placed before the effective date of the RCRA requirements. However, the regulations are described as clearly appropriate in light of the wastes being similar or identical in chemical structure to RCRA hazardous wastes. The design will use RCRA guidance for the cover, control of surface runoff, monitoring ground water quality and for the post-closure care.</b></p>		
<b>AIR EMISSIONS</b>		
<b>STANDARD</b>	<b>CITATIONS</b>	<b>DESCRIPTION</b>
Clean Air Act	42 USC 7401-7642 40 CFR 50 and 52	Establishes a regulatory system for air pollution from stationary and mobile sources.
RCRA Subtitle D Authority **See note below	40 CFR 258	Rules were promulgated October 9, 1991 which describe minimum federal criteria for municipal solid waste landfills.
Ambient Air Quality Standards **See note below	Title 326 IAC Article 1-3	State ARAR as identified by the State of Indiana in the ROD
Indiana VOC Emission Standards **See note below	Title 326 IAC Article 2-1 and 8-1-6	State ARAR as identified by the State of Indiana in the ROD
Indiana Fugitive Dust Control	Title 326 IAC Article 6-4	State ARAR as identified by the State of Indiana in the ROD



**\*\*One of the major components of the selected remedy include the installation of an active landfill gas collection system including a vapor phase carbon system to treat the off-gas from the landfill. The ROD also states that an enclosed ground flare system will be implemented if landfill gas characterization studies indicate VOC emissions exceed ARAR's (Indiana Administrative Code 326 IAC). Under RCRA Subtitle D authority, landfills must be operated to ensure that the concentration of methane gas does not exceed 25% of the lower explosive limit (LEL) in facility structures or the LEL at the facility property boundary. A soil gas survey will be conducted during the predesign investigations to assist in the design of the gas control system and to assure regulatory compliance.**

**7.0. WORK SCHEDULE.** The HIMCO project will track on two separate schedules. The design of the cover system can proceed without the need to obtain any additional predesign data. The design of the gas collection system and borrow pit/wetland areas are dependent upon approval of the Work Plan and on the acquisition of additional field data. The following schedule reflects the timing of all major tasks: With the exception of this Work Plan, the design schedule reflects or accelerates the deadlines contained in the schedule set forth in Table 1 of the SOW. Refer to Table 2 for the Project Design Schedule. An April 29, 1996 completion date of the 100% design package allows for a summer of "96" remedial action activities.

**TABLE 2**  
**HIMCO DUMP PROJECT DESIGN SCHEDULE**

ITEM #	TASK	COVER DESIGN	FIELDWORK
1	Site Visit		April 5, 1995
2	Draft Work Plan Without QAPP & HASP		May 8, 1995
3	Contract with RUST for IH & Chem support		May 8, 1995
4	Revised Work Plan to Include QAPP & HASP		June 20, 1995
5	EPA Review of Draft Work Plan		July 7, 1995
6	Finalize Work Plan		July 25, 1995
7	EPA Obtains Rights-of-Entry		July 25, 1995
8	EPA Approval to Conduct Field Activities		July 31, 1995
9	Complete Field Activities		Sept. 27, 1995
10	Submit Draft Groundwater Sampling Report -Round 1		Sept. 29, 1995
11	Submit 30% Cover Design	Sept. 29, 1995	
12	EPA Review of Draft Groundwater Sampling Report		October 13, 1995
13	EPA & MRD Review 30% Design Complete	October 27, 1995	
14	Finalize Groundwater Sampling Report - Round 1	October 27, 1995	
15	2nd Ground Water Sampling Effort - Field Activity		December 1, 1995
16	Submit Pre-final Design 95%	February 29, 1996	
17	EPA & MRD Review 95% Design	March 29, 1996	
18	3rd Ground Water Sampling Effort - Field Activity		March 1, 1996
19	Final Design 100% (see Comment 10, 11, & 12)	April 29, 1996	

**8.0. PROJECT PERSONNEL.** Table 3 presents a list of the key design team members involved with this project.

<b>TABLE 3</b> <b>HIMCO DUMP DESIGN TEAM MEMBERS</b>				
<b>NAME</b>	<b>OFFICE</b>	<b>DUTY</b>	<b>PHONE</b>	<b>FAX</b>
Turpin Ballard	USEPA	RPM	312-353-6083	312-886-4071
Greg Herring	CEMRO-ED-HS	PM	402-221-7712	402-221-7838
Steve Peterson	CEMRO-ED-EC	TM	402-221-7183	7796 or 7793
Don Moses	CEMRO-ED-GF	Technical Oversight	402-221-3077	402-221-4571
Larry Boardman	CEMRO-ED-GF	PE, Geotech Design	402-221-4706	402-221-4571
Rick Grabowski	CEMRO-ED-GG	Geologist	402-221-7784	402-280-0055
Carl Christian	CEMRO-ED-GF	CADD Technician	402-221-4871	402-221-4571
Ben Letak	CEMRO-ED-GB	Geotech Design	402-221-4406	402-221-4571
Randy Sellers	CEMRO-PD-M	Wetlands Design	402-221-4603	402-221-4886
	CEMRO-ED-DJ	Civil		
	CEMRO-ED-DJ	Erosion Control, Seeding		
	CEMRO-ED-DI	Specifications		
	CEMRO-ED-HE	Hydrology		
	CEMRO-ED-HD	Hydraulics		
	CEMRO-ED-DF	Structural		
Rich Tinsley	RUST	Industrial Hygienist	708-955-6704	
Greg Ruechel	RUST	Chemist	414-451-2522	
	CEMRO-ED-CC	Cost Engineering		

**APPENDIX A**  
**FIELD SAMPLING PLAN (FSP)**

**FINAL**

**ADDENDUM II  
FIELD SAMPLING PLAN  
for  
REMEDIAL DESIGN/REMEDIAL ACTION FIELD ACTIVITIES  
at the  
HIMCO DUMP SUPERFUND SITE  
ELKHART, INDIANA**

***Prepared for:***

**United States  
Environmental Protection Agency  
Region 5  
Chicago, Illinois**

***Prepared by:***

**Department of the Army  
Corps of Engineers  
Omaha District  
Omaha, Nebraska**

**July 1995**

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## LIST OF ACRONYMS AND ABBREVIATIONS

BGS	Below Ground Surface
CASS	Contract Analytical Support Section
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CRL	Central regional Laboratory
DNAPL	Dense Non-Aqueous Phase Liquid
DQCR	Daily Quality Control Reports
F	Fahrenheit
FID	Flame Ionization Detector
FS	Feasibility Study
FSP	Field Sampling Plan
HSA	Hollow-Stem Auger
IDNR	Indiana Department of Natural Resources
ID	Inside Diameter
MCL	Maximum Contaminant Level
mg/L	Milligrams per Liter
MRD	Missouri River Division
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MSL	Mean Sea Level
NGVD	National Geodetic Vertical Datum
NTU	Nephelometric Turbidity Units
NAD	North American Datum
OD	Outside Diameter
OSHA	Occupational Safety and Health Administration
PPM	Parts per Million
PID	Photo-ionization Detector
PCP	Polychlorinated Biphenyls
PPE	Personal Protective Equipment
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RD/RA	Remedial Design/Remedial Action
RI	Remedial Investigation
ROD	Record of Decision

**LIST OF ACRONYMS AND ABBREVIATIONS (CONT.)**

SARA	Superfund Amendment and Reauthorization Act
SAS	Special Analytical Services
SMO	Sample Management Office
SOP	Standard Operating Procedure
SSHP	Site Safety and Health Plan
SVOC	Semi-volatile Organic Compound
ug/L	Micrograms per Liter
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile Organic Compound
UC	Uniformity Coefficient
WP	Work Plan

## **1.0 SITE BACKGROUND AND HISTORY**

A full discussion on the background and history of the Himco Dump Superfund Site is provided in the previously approved Himco Dump Remedial Investigation/Feasibility Study (RI/FS) Work Plan, Volume 1A (Donohue, 1990).

## **2.0 FIELD INVESTIGATION OBJECTIVES AND APPROACH**

### **2.1 Purpose and Scope**

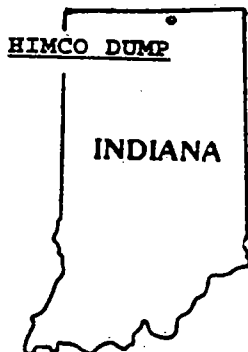
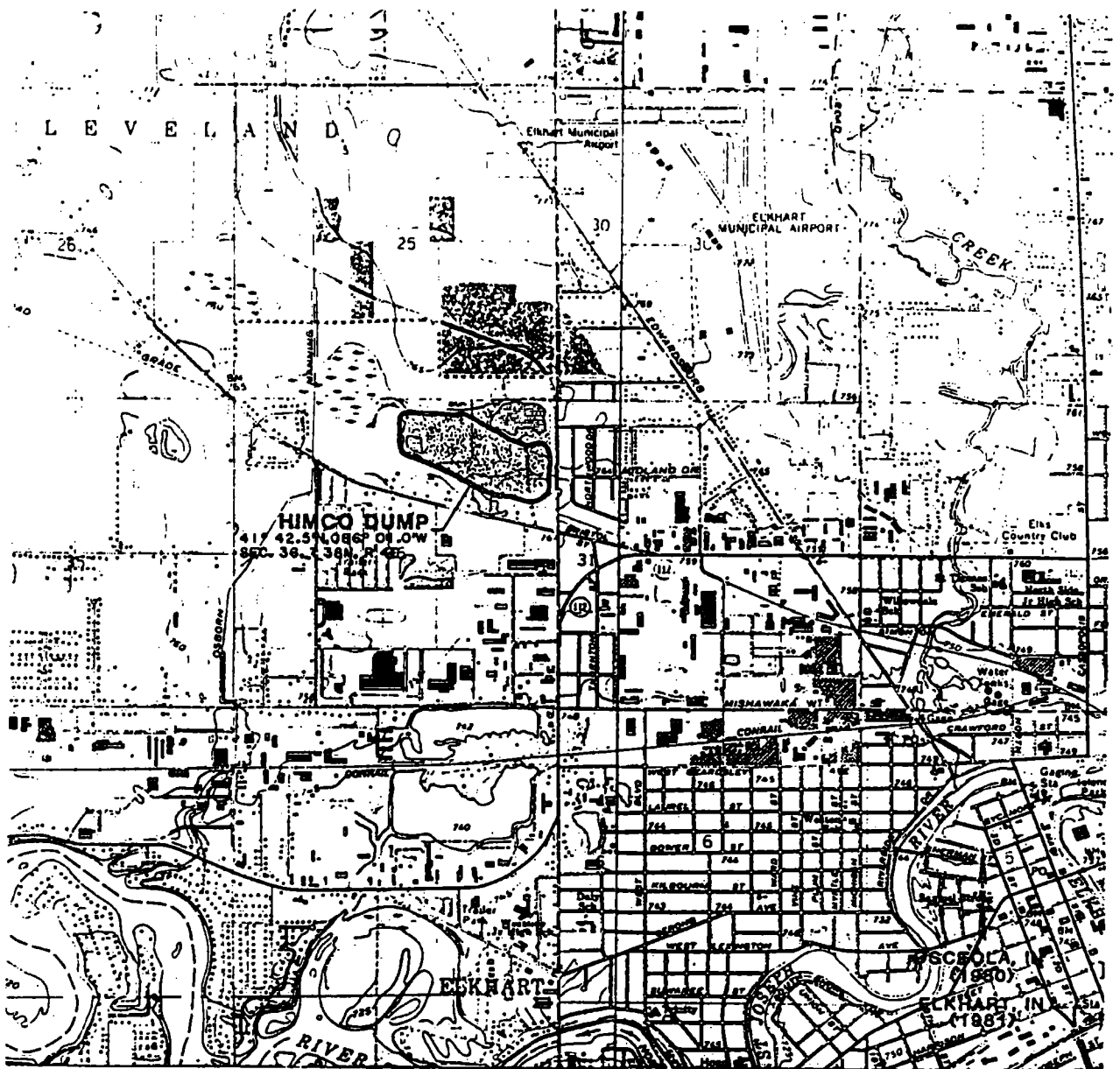
This document is prepared as Addendum II to the Field Sampling Plan (FSP) originally written for RI/FS activities at the Himco Dump Superfund Site, located in Cleveland Township adjacent to the city of Elkhart, Elkhart County, Indiana (Figure 2-1). The purpose of this FSP is to detail methods and procedures for conducting field activities during the Remedial Design/Remedial Action (RD/RA) project phases as required in the Scope of Services (SOS) issued by Region 5 of the United States Environmental Protection Agency (USEPA). Remedial Design/Remedial Action field activities include: a survey of existing monitoring and residential wells to determine their condition and suitability for use in a long-term monitoring program, abandonment of monitoring wells determined not to be suitable for continued monitoring, installation of additional monitoring wells both upgradient and downgradient to supplement existing monitoring wells and provide additional chemical and hydrogeologic data, short-term (periodic) monitoring of the system during the design period, and a soil gas survey to quantify methane generation rates within and along the boundaries of the dump. The FSP describes the site-specific sampling objectives, techniques, analyses, media, locations, and frequencies associated with the tasks outlined above.

The major objective of this RD/RA field study is to determine whether ground water quality in the vicinity of the Himco Site has deteriorated since the time of the last RI sampling, which was performed in September of 1991. Chemical data generated from this proposed study shall be used in conjunction with information from the previous RI site investigations (Donohue, 1992) to fully characterize ground water conditions. The soil gas survey portion of this RD/RA field study is being conducted to support the design of a landfill cap. All activities for this project will be conducted in accordance with provisions of the Comprehensive Environmental Response, Compensation, and Liability Act/Superfund Amendments and Reauthorization Act of 1986 (CERCLA/SARA), and in accordance with appropriate requirements of the National Contingency Plan (NCP).

This effort is part of an Interagency Agreement between the United States Army Corps of Engineers (USACE), Omaha District, and Region 5 of the USEPA. The Scope of Work calls for the preparation of a FSP in conjunction with RD/RA field activities.

### **2.2 Organization of Field Sampling Plan**

This FSP is organized to provide a document that will be used to guide sampling teams during all field activities. Detailed methods and procedures for completion of field activities include: drilling, soil sampling, monitoring well installation and development, water level measurements, ground water sampling, boring abandonment, decontamination, handling of investigation derived waste,



Source: USGS 7.5 Minute Quadrangle  
Osceola, Indiana (1980)  
Elkhart, Indiana (1981)

Scale: 1 inch equals 2000 feet

2A-2  
Figure 2-1 Site Location Map

surveying, soil gas sampling, and field instrument calibration/preventative maintenance.

The contents of this FSP include those suggested elements found in *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA, 1988), with the following exceptions. A complete discussion of the site background and history, sample identification numbers and documentation, chain of custody, and sample packaging and shipping procedures are found in the previously approved Himco Dump RI/FS Work Plan (Donohue, 1990). The remaining Sections of this document which contain information that is substantially different from the RI/FS Work Plan are formatted as follows: Field Team Organization and Responsibilities (Section 3) and Media-Specific Sampling Plans (Section 4).

Other documents associated with this FSP include the Quality Assurance Project Plan (QAPP) and Site Safety and Health Plan (SSHP).



### **3.0 FIELD TEAM ORGANIZATION AND RESPONSIBILITIES**

The organizational structure and responsibilities for key field team members is outlined below, and is designed to provide adequate project control and proper quality assurance for investigative activities at the project site.

#### **Project Geologist**

The Project Geologist is primarily responsible for technical input to the FSP, coordination/implementation of the field work to ensure that data collected will support the intent of the sampling effort, providing direction to the project field team, and completion of progress or other required management reports to USACE Omaha District team members. The Project Geologist may assist in the field activities if needed.

#### **Project Chemist/Quality Assurance Coordinator**

The Project Chemist/Quality Assurance Coordinator is primarily responsible for completion of the QAPP, and providing guidance on chemical sampling, including strict quality control and data acquisition methods and procedures. The Project Chemist/Quality Assurance Coordinator is also responsible for coordinating off-site laboratory analysis, and assuring the technical quality of field and laboratory reports where they concern chemical data acquisition.

#### **Safety and Health Coordinator**

The Safety and Health Coordinator is responsible for preparation of the SSHP, overview of medical surveillance, training, and monitoring programs, and responding to any non-routine matters that relate to health, safety, and emergency response during the project life.

#### **Lead Field Geologist/Site Coordinator/Site Safety and Occupational Health Officer**

The Lead Field Geologist will serve as the Site Coordinator and the Site Safety and Occupational Health Officer. The Site Coordinator will be responsible for technical completion of all field activities according to the FSP, implementing task-related aspects of project quality assurance/quality control (QA/QC), coordinating field activities among all members of the field team, and acting as the communication link between the field team and the Project Geologist. The Site Coordinator will assign specific field duties to team members and will be on-site during all field activities. All other field team members will report directly to the Site Coordinator. The Site Coordinator will oversee as well as participate in mobilization, drilling, sampling, sample packaging/shipping, decontamination, and demobilization activities. Any logistical problems

hindering field activities such as equipment malfunctions or availability, etc. will be resolved by the Site Coordinator. The Site Coordinator will be responsible for completing all daily field documentation forms as indicated in the FSP, including a daily logbook, chain-of-custody forms, laboratory transmittals, daily quality control reports (DQCRs), and daily exploration reports. In the event problems or circumstances arise which could affect the success of the program, the Site Coordinator will immediately notify the Project Geologist.

The Site Safety and Occupational Health Officer is responsible for monitoring and enforcing provisions of the SSHP. During field activities, the Site Safety and Occupational Health Officer must ensure that a site safety meeting is conducted with all on-site personnel at least once a week or when initiating work in a new site location, and that a written record is maintained in the field logbook which notes the date, time, attendance, subjects discussed, and who conducted the meeting. The Site Safety and Occupational Health Officer must also ensure that all field equipment, including safety equipment, is adequate and suitable for its intended use as well as in good working condition, and that daily field instrument calibrations activities are recorded in the field logbook.

## 4.0 MEDIA-SPECIFIC SAMPLING PLANS

### 4.1 Sampling Objectives

The major objective of the field study at the Himco Site is to collect additional data as necessary to determine whether ground water quality has deteriorated since the last sampling round was conducted. This occurred during phase II of the RI in September of 1991. A secondary objective of this field study is to obtain the necessary information for design of a landfill gas collection system.

Matrix and site specific sampling objectives include collecting additional data to:

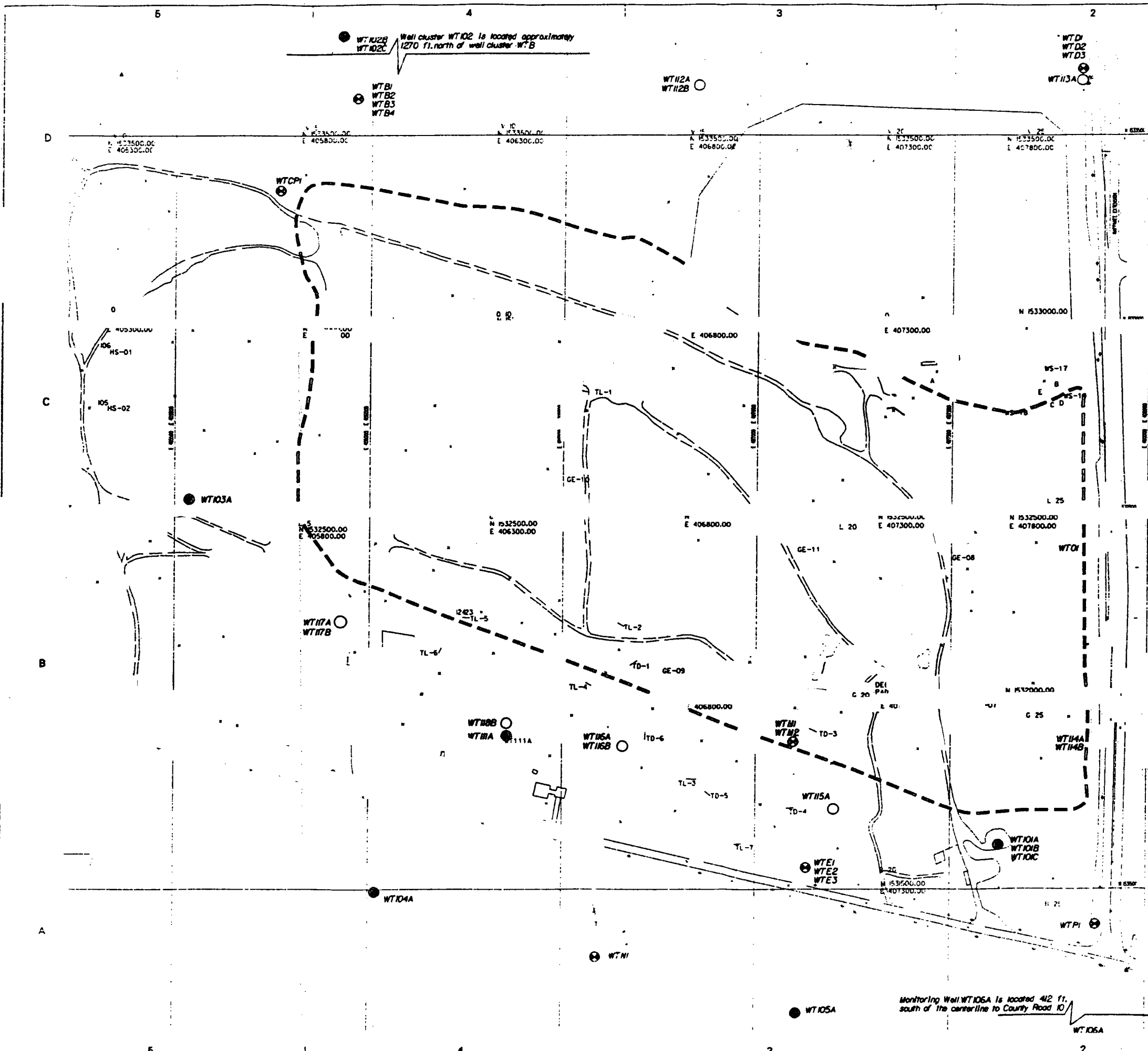
#### Subsurface Soil

- Further characterize the stratigraphy and physical properties of the soils.
- Assess the occurrence and levels of methane gas generation.

#### Ground Water

- Characterize concentrations of organic and inorganic contaminants within the shallow and intermediate portions of the water table aquifer south and east (downgradient) of the landfill boundary.
- Evaluate whether levels of inorganic contamination existing in ground water within the shallow and intermediate portions of the water table aquifer are a result of site activities at the Himco Site or if they are representative of natural background levels.
- Further assess the occurrence of ground water in the shallow and intermediate portions of the water table aquifer underneath and immediately adjacent to the Himco Site.

The field activities which follow are intended to meet the sampling objectives listed above. Proposed monitoring well and soil gas sampling locations are shown on Figures 4-1 and 4-2, respectively. The projected analytical sampling breakdown for ground water may be found in Table 4-1. Sample volumes, containers, and preservatives required may be found in Table 4-2 of the previously approved FSP (Donohue, 1990). Information on analysis methods and data management may be found in the original and Addendum II QAPPs for the Himco Site.



- LEGEND**
- Approximate Landfill Limits
  - WT101A Existing RI Monitoring Well
  - WT101 Existing USGS Monitoring Well
  - WT104A Proposed Monitoring Well

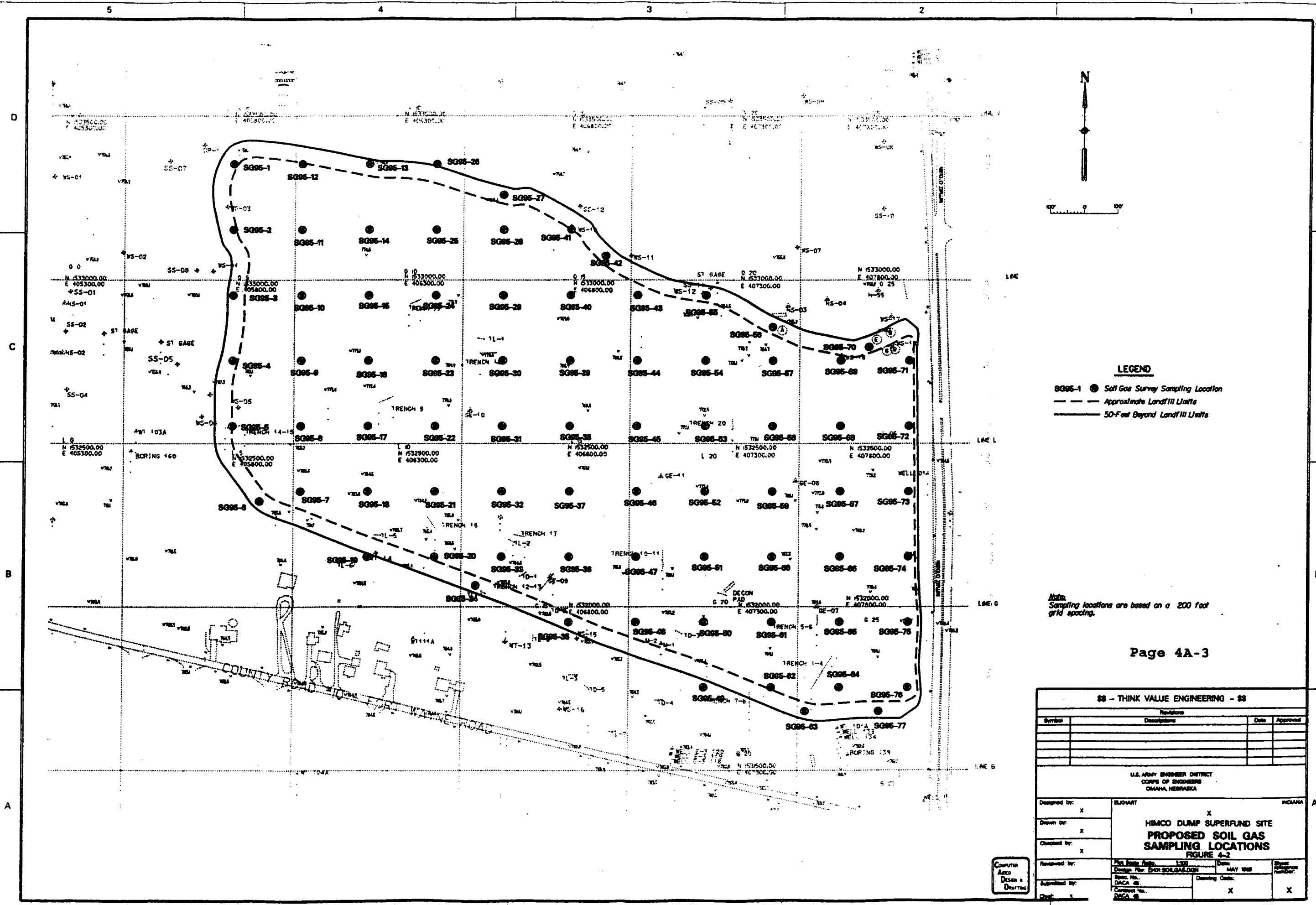
Page 4A-2

\$\$ - THINK VALUE ENGINEERING - \$\$

U.S. ARMY ENGINEER DISTRICT  
CORPS OF ENGINEERS  
OMAHA, NEBRASKA

HIMCO DUMP SUPERFUND SITE  
EXISTING AND PROPOSED  
MONITORING WELL LOCATIONS

DESIGNED BY:	X	INCHMAN	A
DRAWN BY:	X		
CHECKED BY:	X		
APPROVED BY:	X		
DATE:	X		
BY:	X		
	X		
	X		



**LEGEND**

SG95-1 ● Soil Gas Survey Sampling Location

--- Approximate Landfill Limits

— 50-Foot Beyond Landfill Limits

*Note:*  
Sampling locations are based on a 200 foot grid spacing.

SS - THINK VALUE ENGINEERING - SS			
Revisions			
Symbol	Description	Date	Approved

U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA			
Designed by:	X	ELIOWART	INDIANA
Drawn by:	X		
Checked by:	X		
Reviewed by:	X		
Submitted by:	X		

HIMCO DUMP SUPERFUND SITE PROPOSED SOIL GAS SAMPLING LOCATIONS FIGURE 4-2			
Plan Scale: As Shown	1:50	Date: MAY 1988	Sheet Number: 1
Design File: BOR-SOLGAS.DGN		Drawing Code: X	
Spec. No.: DCA 45			
Contract No.: DCA 45			

Computer  
Aided  
Design &  
Drafting

TABLE 4-1

**SAMPLING AND ANALYSIS SUMMARY**  
**REMEDIAL DESIGN/REMEDIAL ACTION FIELD ACTIVITIES**  
**HIMCO DUMP SUPERFUND SITE**  
**ELKHART, INDIANA**

SAMPLE MATRIX	FIELD PARAMETERS	DQO LEVEL	LAB PARAMETERS	DQO LEVEL	LAB	# FIELD SAMPLES	FIELD QC			TOTAL TO LAB	LAB QC		USACE QA		
							TB <sup>(1)</sup>	RB	FD <sup>(2)</sup>		LD/MS/MSD <sup>(3)</sup>	TB	RB	FI <sup>(4)</sup>	
Existing USGS Wells (Groundwater)	Water Level	I	TCL VOC	IV	CLP	8	2	1	1	12	1	1	-	1	
	pH	I	TCL SVOC	IV	CLP	8	-	1	1	10	1	-	-	1	
	Conductivity	I	TCL Pest/Aroclor <sup>(5)</sup>	IV	CLP	8	-	1	1	10	1	-	-	1	
	DO	I	TAL Metals/CN	IV	CLP	8	-	1	1	10	1	-	-	1	
	Temperature	I													
	Turbidity	I	(Total) <sup>(6)</sup>												
New Installed Wells (Groundwater)	Water Level	I	TCL VOC	IV	CLP	11	3	1	1	16	1	1	-	1	
	pH	I	TCL SVOC	IV	CLP	11	-	1	1	13	1	-	-	1	
	Conductivity	I	TCL Pest/Aroclor <sup>(5)</sup>	IV	CLP	11	-	1	1	13	1	-	-	1	
	DO	I	TAL Metals/CN	IV	CLP	11	-	1	1	13	1	-	-	1	
	Temperature	I													
	Turbidity	I	(Total) <sup>(6)</sup>												
Water Source Blanks	pH <sup>(7)</sup>	I	TCL VOC	IV	CLP	2	1	-	-	3	-	-	-	-	
	Conductivity	I	TCL SVOC	IV	CLP	2	-	-	-	2	-	-	-	-	
	Temperature	I	TCL Pest/Aroclor <sup>(5)</sup>	IV	CLP	2	-	-	-	2	-	-	-	-	
			TAL Metals/CN	IV	CLP	2	-	-	-	2	-	-	-	-	
			(Total) <sup>(6)</sup>												
Soil Gas	Methane	I	N/A	N/A	N/A	462 <sup>(8)</sup>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
NOTES: <sup>(1)</sup> Trip Blanks will be shipped at frequency of one per cooler of aqueous samples for VOC analysis. This number is an estimate based on the number of coolers anticipated to be shipped. <sup>(2)</sup> MS/MSD samples required for organic analysis. Groundwater samples shall be collected, with extra sample volume at a frequency of one per 20 or fewer investigative samples. Triple the normal volume will be collected for VOCs and double the normal volume will be collected for SVOCs and Pest/Aroclor. <sup>(3)</sup> The terms Aroclor and Polychlorinated Biphenyl (PCB) can be interchangeable. <sup>(4)</sup> Total metals are defined as digestion and analysis of TAL metals on an unfiltered sample. <sup>(5)</sup> Field Parameters will only be collected at the water supply point. <sup>(6)</sup> One field duplicate to be collected from the shallow aquifer and one field duplicate to be collected from the intermediate aquifer. <sup>(7)</sup> Number of field samples for methane soil gas, 462 samples, represents 6 measurements at each of the 77 sample points.															
LEGEND:															
USGS	United States Geological Survey	VOC	Volatile Organic Compounds	RB	Reactive Blank										
CLP	Contract Laboratory Program	SVOC	Semi-Volatile Organic Compounds	FD	Field Duplicate										
QC	Quality Control	Pest	Pesticidal Particles	LD	Laboratory Duplicate										
TCL	Target Compound List	CN	Cyanide	MS/MSD	Matrix Spike/Matrix Spike Duplicate										
TAL	Target Analyte List			TB	Trip Blank										
DO	Dissolved Oxygen														

## **4.2 Monitoring and Residential Well Survey**

### **4.2.1 Introduction**

A survey of all monitoring wells within and immediately adjacent to the Himco Site, along with residential wells to the south of the Himco Site along County Road 10, shall be conducted. The purpose of this well survey is to document the condition of the wells and determine whether they may be suitable for continued use to obtain ground water samples/elevations, or whether they should be abandoned. Only monitoring wells installed for the RI will be abandoned by the USACE Omaha District during the course of this field investigation. All water wells recommended for abandonment should be done by a state licensed water well driller. Monitoring wells installed for a United States Geological Survey (USGS) ground water investigation are currently being used for bi-annual water level and water quality measurements by the Elkhart Water Works. The city may prefer to rehabilitate or repair one of these monitoring wells versus abandonment. Recommendations for USGS monitoring wells will be given to the USEPA and Elkhart Water Works.

Monitoring wells to be examined include all eleven installed between 1990 and 1991 during the RI field investigation ( WT101A, WT101B, WT101C, WT102A, WT102B, WT102C, WT103A, WT104A, WT105A, WT106A, and WT111A), and sixteen installed between 1977 and 1979 during the USGS hydrogeological investigation (WTB1, WTB2, WTB3, WTB4, WTCP1, WTD1, WTD2, WTD3, WTE1, WTE2, WTE3, WTM1, WTM2, WTN1, WTO1, and WTP1). Figure 4-1 shows the locations of all monitoring wells to be investigated during this survey. The remaining monitoring wells installed during the USGS hydrogeological investigation will not be examined as they are considered to be too far away from the project site.

A review of available literature on the hydrogeology of the site area (Duwelius and Silcox, 1991) shows three monitoring wells (C1, C3, and C4) installed by the USGS in 1977 which are located immediately adjacent to the southwest boundary of the landfill. These wells are not shown in the Final RI Report (Donohue, 1992), and they were never sampled during the RI field investigation. An effort will be made to locate these wells, but they may have been damaged or abandoned, which would account for a lack of their use. It should be noted that shallow monitoring well WT103A is located in the vicinity of these wells. Monitoring wells WTD1 through WTD3 and WTE1 were never sampled during the RI effort (Donohue, 1992). It is unclear why these wells were not used for the RI investigation; however, their location and construction details make some of these wells viable candidates for use in a long-term monitoring system for the landfill. An attempt will be made to locate and examine these wells. The location for monitoring well WTN1 was not shown in the original drawing used for Figure 4-1, and has been approximated.

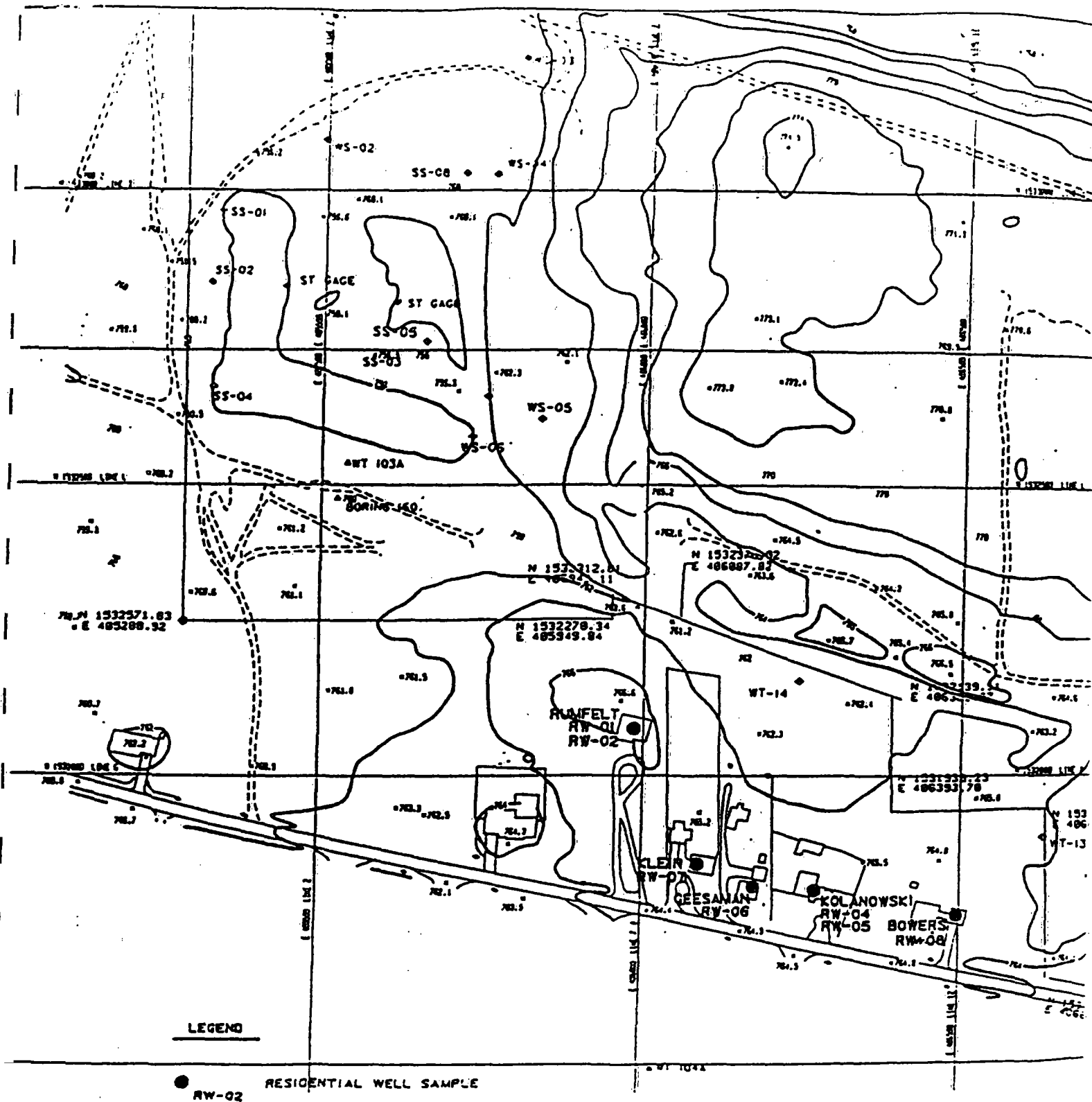
Residential water wells to be examined include shallow and deep wells on properties immediately adjacent to the site along County Road 10 (south of the landfill). According to the Final RI Report (Donohue, 1992), the shallow wells were taken out of service in 1974 due to concerns over high levels of manganese which may have been related to the Himco Site, and were replaced with deep wells. The deep water wells were taken out of service in 1990 after the phase I sampling event due to concerns over high sodium concentrations that were detected from an earlier USEPA sampling event. Both shallow and deep water wells serving residential and commercial buildings to the east and southeast of the site are not tentatively scheduled to be investigated. As of 1991, none of these wells had been determined to be contaminated, and all wells were in service as the City of Elkhart did not supply municipal water to this area. Prior to initiating the well survey, the appropriate State of Indiana and Elkhart municipal offices will be contacted to obtain copies of any available well logs and/or abandonment reports, to ascertain whether municipal water service has been extended to those areas identified above, and/or if any water wells have been taken out of service since 1991.

The list of shallow water wells to be examined includes RW-02 and RW-05, which are shown on Figure 4-3. According to the Final RI Report (Donohue, 1992), a shallow well exists on the Klein property and the property west of the Rumfelt residence, but their location was not indicated; therefore, they cannot be shown on Figure 4-3. If these wells are determined to exist, then they will be included in the well survey. Conversations with the landowner of the property behind the Geesaman residence during the April 1995 site visit revealed a water well of unknown depth which is no longer in service. This well will also be included in this survey. The three additional shallow wells identified above will be designated RW-09, RW-10, and RW-11. Deep water wells to be surveyed include RW-01, RW-04, RW-06, RW-07, and RW-08.

#### **4.2.2 Equipment and Procedures**

Prior to initiating the well survey, residential well owners will be contacted by telephone to ensure that the owner of the well or a tenant is present and can assist the survey team with problems of well location, identification, access, etc., should they arise. The well survey will consist of visually inspecting the protective casing, riser, and bollards (if present). Any locks on the protective casing or well cap will be cut using bolt cutters, and will be replaced such that all locks are keyed alike. One set of keys will be kept by the USACE Project Geologist, and one set of keys will be provided to the USEPA Remedial Project Manager. Should the Elkhart Water Works wish to continue their bi-annual ground water sampling from any of the monitoring wells associated with the Himco Site, then arrangements can be made to provide a set of keys to their General Manager. A water level and depth to bottom will be obtained for each well in accordance with Paragraph 4.3.3.2 of this FSP. If it is determined that a water well is being used as a potable water supply, then no equipment will be introduced into that well. A clean 5-foot





4A-7

Figure 4-3 Residential Water Well Locations

long by 1.25-inch nominal diameter (1.66-inch outside diameter) schedule 40 polyvinyl chloride (PVC) pipe filled with clean filter pack sand and capped at both ends will then be lowered down the riser of all monitoring wells to ensure each well is plumb, aligned, and that the ground water sampling pump specified in Paragraph 4.3.4.2 can be used. Only new rope will be used to lower the slug down the well in order to prevent any possibility of cross-contamination.

#### **4.2.3 Equipment Decontamination**

All equipment coming into contact with ground water will be cleaned prior to use at each well in the following manner:

1. non-phosphate detergent wash using a brush
2. potable water rinse
3. triple deionized, distilled water rinse

Decontaminated equipment will be stored in new plastic garbage bags and sealed when not in use. The waste liquids from decontamination of all equipment will be handled in accordance with Paragraph 4.5 of this FSP.

#### **4.2.4 Quality Control**

All field documentation will undergo an internal QC review after the completion of field activities associated with the monitoring and residential well survey. The original field logbook will be reviewed by the Project Geologist for completeness, accuracy, and compliance with the FSP and QAPP.

#### **4.2.5 Documentation**

Data collected and observations made during the monitoring and residential well survey will be recorded in the project field logbook. Photographs will also be taken of all locations.

### **4.3 Ground Water Sampling Plan**

A monitoring well network consisting of existing and newly constructed wells will be used to determine changes in ground water quality since the last sampling round during the RI, and to monitor the effectiveness of the remedial action should the cap be built. One round of ground water sampling will be performed by USACE Omaha District personnel following completion of new monitoring well installations. The results of this latest sampling round will be compared to those of the RI, and a determination will be made by the USEPA whether additional sampling is

warranted. If the results are comparable between the two sampling rounds, then there should be no further need for sampling by the USACE.

#### 4.3.1 Soil Borings/Sampling for Monitoring Wells

##### 4.3.1.1 Introduction

A complete examination of the location and construction details for all existing monitoring wells within and immediately adjacent to the Himco Site was performed for the purpose of identifying wells which may potentially be used for the periodic and long-term ground water quality monitoring. Table 4-2 summarizes those observations and notes the status for each well. The recommendations found in Table 4-2 and below are based on the documentation provided in the Final RI Report (Donohue, 1992). Those wells recommended for further use are to be examined during the well survey for suitability. If they are not found to be useable for any reason, then they will be replaced at the time new monitoring wells are installed. USGS monitoring wells recommended for use include WTD3, WTE1, and WTO1. RI monitoring wells recommended for use include WT101A, WT101B, WT102A, WT102B, and WT111A. The location and screened interval of these existing wells are similar to the additional wells proposed below.

TABLE 4-2  
MONITORING WELL EVALUATION  
FIELD SAMPLING PLAN  
HIMCO DUMP SUPERFUND SITE  
ELKHART, INDIANA

Monitoring Well Designation	Well Construction Observations	Suitability for Use
WT101A	Well constructed properly; redevelopment recommended due to elevated turbidity levels noted while purging well for sampling.	Acceptable
WT101B	Well constructed properly.	Acceptable
WT101C	Well constructed properly; screen is set too deep to be used for this monitoring program.	Not Acceptable
WT102A	Well constructed properly.	Acceptable
WT102B	Well constructed properly.	Acceptable

TABLE 4-2 (CONTINUED)  
MONITORING WELL EVALUATION  
FIELD SAMPLING PLAN  
HIMCO DUMP SUPERFUND SITE  
ELKHART, INDIANA

Monitoring Well Designation	Well Construction Observations	Suitability for Use
WT102C	Only a 0.5 foot thick concrete collar at top of boring. Protective casing must penetrate past the concrete and into the grout below; screen is set too deep to be used for this monitoring program.	Not Acceptable
WT103A	Well constructed properly; located sidegradient to the landfill boundary.	Not Acceptable
WT104A	Well constructed properly; located too far downgradient; redevelopment recommended if well used for ground water quality monitoring in the future due to elevated turbidity levels noted while purging well for sampling.	Not Acceptable
WT105A	Well constructed properly; located too far downgradient.	Not Acceptable
WT106A	Well constructed properly; located too far downgradient.	Not Acceptable
WT111A	Unsure whether filter pack is properly sized for the formation; remainder of construction details are okay.	Acceptable
WTB1	Well construction details are sketchy; screen is set too deep to be used for this monitoring program.	Not Acceptable
WTB2	Well construction details are sketchy; black steel used for riser/screen.	Not Acceptable
WTB3	Well construction details are sketchy; size and type of riser/screen (5-inch PVC) are acceptable, but screen is set too deep to be used for this monitoring program.	Not Acceptable
WTB4	Well construction details are sketchy; size and type of riser/screen (5-inch PVC) are acceptable, but screen is set too deep to be used for this monitoring program.	Not Acceptable

TABLE 4-2 (CONTINUED)  
MONITORING WELL EVALUATION  
FIELD SAMPLING PLAN  
HIMCO DUMP SUPERFUND SITE  
ELKHART, INDIANA

Monitoring Well Designation	Well Construction Observations	Suitability for Use
WTCP1	Well construction details are unknown; well materials unknown; well location too close to landfill boundary and area may have been impacted by previous site operations.	Not Acceptable
WTD1	Well construction details are sketchy; black steel used for riser/screen.	Not Acceptable
WTD2	Well construction details are sketchy; size and type of riser/screen (5-inch PVC) are acceptable, but screen is set too deep to be used for this monitoring program.	Not Acceptable
WTD3	Well construction details are sketchy; size and type of riser/screen (5-inch PVC) are acceptable, screen is set at the appropriate depth.	Acceptable
WTE1	Well construction details are sketchy; size and type of riser/screen (5-inch PVC) are acceptable, screen is set at the appropriate depth.	Acceptable
WTE2	Well construction details are sketchy; black steel used for riser/screen.	Not Acceptable
WTE3	Well construction details are sketchy; size and type of riser/screen (5-inch PVC) are acceptable, but screen is set too deep to be used for this monitoring program.	Not Acceptable
WTM1	Well construction details are sketchy; type of riser/screen (2-inch galvanized steel) are unacceptable; screen is set at the appropriate depth; located within landfill boundary.	Not Acceptable
WTM2	Well construction details are sketchy; size and type of riser/screen (2-inch PVC) are acceptable; screen is set at the appropriate depth; located within landfill boundary.	Not Acceptable

TABLE 4-2 (CONTINUED)  
MONITORING WELL EVALUATION  
FIELD SAMPLING PLAN  
HIMCO DUMP SUPERFUND SITE  
ELKHART, INDIANA

Monitoring Well Designation	Well Construction Observations	Suitability for Use
WTN	Well construction details are sketchy; size and type of riser/screen (2-inch PVC) are acceptable; screen is set at the appropriate depth; located too far downgradient.	Not Acceptable
WTO1	Well construction details are sketchy; size and type of riser/screen (2-inch PVC) are acceptable, screen is set at the appropriate depth.	Acceptable
WTP1	Well construction details are sketchy; size and type of riser/screen (2-inch PVC) are acceptable, screen is set at the appropriate depth; not needed due to coverage by other monitoring wells in the area of WTP1; located slightly further downgradient than desired.	Not Acceptable

All wells to be constructed for this network will be located horizontally such that they monitor the point of compliance, which is the boundary of the landfill. For cap construction purposes, wells should be located no closer than 100 feet from the landfill boundary. This would place the wells beyond the toe of the cap, where they will not be disturbed during construction, but at the same time, will be close enough to the downgradient edge of the landfill for immediate detection.

Newly constructed wells will be screened vertically such that they intercept the most probable path(s) of contaminant migration. A review of the lithologic and hydrologic data from the Final RI Report (Donohue, 1992) shows no obvious conduits along which contaminants would preferentially migrate. Lithologic logs show a predominance of poorly to well graded sands and gravels, with some minor lenses of silty gravel/silty sand and thin stringers of silt/clay. In addition, piezometric data indicates a very low horizontal hydraulic gradient, and a very slight upward gradient. No dense phase miscible or immiscible liquids are known to have been disposed of at the site. A review of previous ground water sampling results from the RI indicates two compounds (1,1- and 1,2-Dichloroethane) whose density is greater than water; however, dissolved phase concentrations are not suggestive of a dense non-aqueous phase liquid (DNAPL). For these reasons, wells will be constructed to monitor the shallow (at the water table) and intermediate

(approximately 60 feet below ground surface) portions of the water table aquifer. The intermediate zone of the aquifer was chosen to help monitor the effectiveness of the remedy.

A total of eleven additional ground water monitoring wells are proposed at various locations and depths around the Himco Site. Six monitoring wells will be completed across the water table, and five in the intermediate portion of the aquifer. Depths to the bottom of the shallow and intermediate monitoring wells are expected to be approximately 17 feet and 60 feet, respectively. All borings advanced for monitoring wells will be sampled continuously (disturbed samples only) for lithologic descriptions along the entire length of the hole. No soil samples will be taken for chemical testing. One soil sample per well boring will be taken from the screened interval and tested for grain size distribution, and Atterberg limits if it is a fine-grained material. Ground water samples obtained from these new wells will be analyzed for Volatile Organic Compounds (VOCs), Semi-Volatile Organics (SVOCs), Pesticides/Polychlorinated Biphenyls (PCBs), and Metals. Previous monitoring well designations from the RI investigation will be continued for this study.

Two shallow monitoring wells (WT112A, WT113A) and one intermediate monitoring well (WT112B) will be constructed upgradient of the area impacted by site activities to provide additional background ground water data. A comparison of ground water quality data between upgradient monitoring wells WTD1 and WTD3 indicates a consistent difference in geochemical parameters between the shallow and intermediate portions of the water table aquifer over a period of nine years (USGS, 1991). In particular, dissolved oxygen levels (which can be related to the Eh) vary widely, which in turn may affect the concentrations of redox sensitive species. Therefore, background data will be obtained separately from the shallow and intermediate portions of the water table aquifer. Combined ground water quality data from existing wells WT102A, WT102B, WTD3, and the newly installed wells will provide three data points each for both the shallow and intermediate portions of the water table aquifer.

One set of nested wells (WT114A, WT114B) will be constructed downgradient of the eastern-most landfill boundary along Nappanee Street Extension. Three shallow wells (WT115A, WT116A, and WT117A) and three intermediate wells (WT116B, WT117B, and WT118B) will be located on the downgradient edge of the landfill and due south of the landfill boundary. These wells are designed to supplement existing well coverage and decrease the distance between monitoring points to an appropriate distance given the site hydrogeologic characteristics and waste disposal history. Intermediate well WT118B will be co-located with existing well WT111A. An intermediate well is not needed at the proposed location of WT115A as an existing well (WTE1) is located slightly downgradient and will be used in the monitoring well network. It is not felt that these wells should necessarily be located immediately adjacent to each other as vertical gradients are not of concern at the Himco Site.

Potentially, wetlands may be created north of the landfill should a suitable on-site borrow area be identified and used during construction of the landfill cap. Access to proposed monitoring well location WT112A/WT112B may be affected by the creation of any wetlands, and should be taken into account when locating the potential borrow/wetland area.

#### **4.3.1.2 Equipment and Procedures**

##### **4.3.1.2.1 Clearances**

The USACE Omaha District will coordinate and obtain all utility clearances with the City of Elkhart as necessary, and all commercial utility companies. Approximately three days prior to the start of any intrusive activities, all boring locations will be staked by a geologist. Boring locations will be measured from existing landmarks and/or based on physical features of the site (buildings, fences, trees, etc.). The Underground Hotline - Miss Dig service will be called at least two days prior to intrusive activities for underground utility clearances. Utilities covered by this service should include gas, electric, telephone, and cable television. The City of Elkhart will be contacted at the same time to ensure that no public works will be affected by the intrusive activities. The USACE Omaha District will relocate any holes, as necessary for utility clearances, to suitable locations which accomplish the intent of the original location. The new location will be as close as possible to the original location, and both locations will be shown on the drill log.

##### **4.3.1.2.2 Water Source**

Water for drilling, steam cleaning, and other necessary field activities will be arranged for by the USACE Omaha District. The USACE Omaha District field personnel will attempt to use municipal water from a fire hydrant located in front of the Elkhart Water Works. The City of Elkhart will be contacted at least three days prior to obtaining any water from the hydrant. Water will be sampled once at each source, and tested for the same parameters specified for ground water samples. In addition, one sample will be obtained from the transport/delivery vessel, and tested for the same parameters as the source sample(s). The USACE Missouri River Division (MRD) lab will provide any deionized water required to perform the work specified in this FSP.

All water supply points will be sampled prior to their use according to the following instructions. The supply point will be opened and water will be allowed to flow for a minimum of 5 minutes to remove any stagnant/standing water from the line. All water will be allowed to discharge to the ground as the source is a municipal supply and the water is expected to be free of any contamination. During "purging", water quality readings (pH, temperature, and conductivity) will be taken at a rate of one per minute. After readings have stabilized (less than 0.2 pH units and a 10% change for the other parameters between four consecutive readings), the flow will be



reduced and a sample will be collected. The transport/delivery vessel will be sampled at the same time as the water supply point, and immediately after filling. Sampling will be conducted through any hoses etc. that will be used to deliver water during the course of these field activities. No purging will be performed, and no water quality parameters will be taken while sampling the transport/delivery vessel.

#### **4.3.1.2.3 Drilling**

A Gus Pech 1100C truck-mounted drilling rig will be used to complete all drilling activities. Drilling in unconsolidated deposits will be performed using continuous flight hollow-stem augers (HSA). Shallow monitoring wells will be drilled/installed using 4 1/4-inch inside diameter (I.D.) augers, and 6 1/4-inch I.D. augers will be used to drill/install the intermediate monitoring wells. These size augers will allow soil samples to be collected from inside the auger barrel using a CME continuous sample tube system, and 2-inch nominal diameter monitoring well casing can be installed with a sufficient amount of annular space for placement of filter pack and sealant materials. A schematic diagram of the CME continuous sampler system may be found in Figure 4-4. A basket retainer will be used to improve core recovery. Should flowing sands be encountered while drilling and sampling, then water from the designated source will be added into the hollow-stem augers in an attempt to maintain sufficient positive head to offset the hydrostatic pressure of the formation. Stainless steel knock out plugs will be used to facilitate installation of all monitoring wells where flowing sands are present.

The rig will be free of leaks which could contaminate the holes (i.e. hydraulic fluid, oil, gas, etc.). No grease or oil will be used on drill pipe joints; however, Teflon tape or vegetable oil may be used. The use of any joint lubricants and any applicable brand names will be documented on the drill logs.

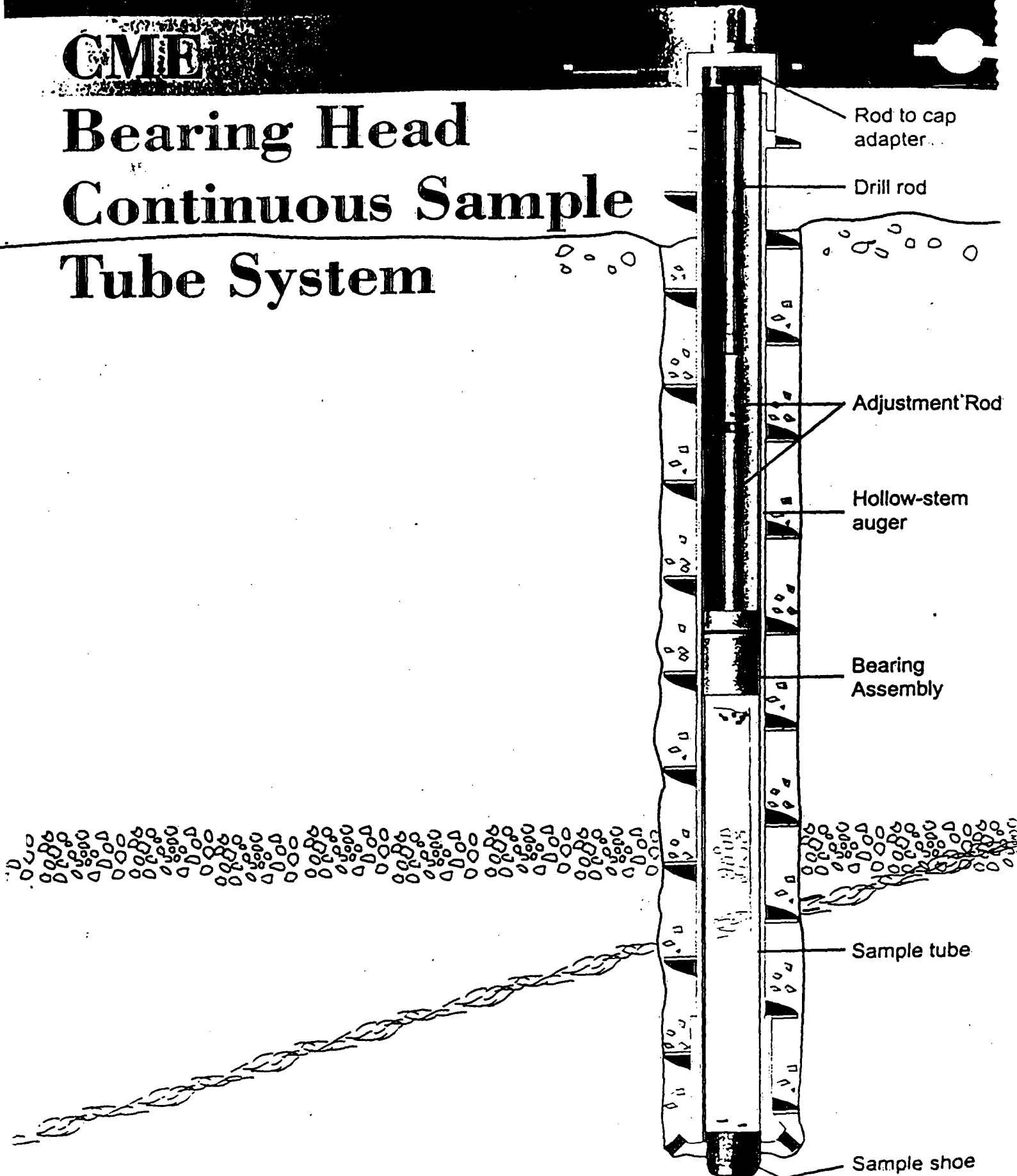
#### **4.3.1.2.4 Subsurface Soil Sampling**

Before beginning the drilling process, field meters will be calibrated in accordance with the Standard Operating Procedures (SOPs) found in Attachment 1 of the QAPP Addendum. Results of meter calibrations will be recorded in the project field logbook. Procedures for field screening measurements may also be found in Attachment 1 of the QAPP Addendum.

The deepest hole at each location will be drilled first and soil samples will be obtained along the entire length of the hole for logging purposes. If a second well is scheduled to be drilled/installed at that same location, then soil sampling in the second boring will only be performed in the projected screened interval.

**CME**

# Bearing Head Continuous Sample Tube System



When soil samples are to be collected, a 5-foot capacity carbon steel split-sample tube and shoe will be connected to the bottom of the center drill stem via a bearing assembly and adjustment rod, and lowered to the bottom of the lead auger. The bearing assembly will isolate the sample tube from rotation of the augers and drill rod, while the adjustment rod will allow for positioning the sample tube and shoe within the lead auger. The sample shoe will be extended in front of the auger teeth to facilitate core recovery. As the augers are turned and downward thrust is applied, a disturbed specimen enters the sample barrel.

Upon advancing the augers a complete 5-foot run, the augers will be broken down and the drill rod pulled out of the hole along with the sample tube. The sample tube will be removed from the drill rod by one of the field crew wearing clean gloves. The same person handling the sample tube will take off the head and shoe. The sample tube will be split by the geologist. Upon opening of the sampler, any slough will be removed, the entire length of the core will be field screened using a photoionization detector (PID), the amount of sample recovery will be measured, and the appropriate information for logging will be taken.

A representative sample will be retained for geotechnical analysis from the interval where the monitoring well screen will be placed. Geotechnical samples will be placed in pint jars, and the lids sealed with three wraps of electrical tape. A separate geotechnical sample will be taken of each lithologic unit encountered in the screened interval. If sample volume is not sufficient for testing requirements, then additional material of similar lithology will be obtained from the interval immediately below.

All cuttings generated from the borings will be handled according to the procedures outlined in Paragraph 4.5 of this FSP.

#### **4.3.1.3 Equipment Decontamination**

A centralized decontamination area will be used for decontamination of the drill rig and all drilling equipment. The selected locale will be situated adjacent to the fenced area in the southeastern portion of the site. This area was chosen as it will not impact any drilling/sampling operations, and is conveniently located close to County Road 10 and is off the landfill proper.

The drill rig and all drilling equipment (augers, center plug, drill rods, casing, etc.) will be steam cleaned. Care will be taken to clean all work surfaces and the vehicle wheels. The drill rig and equipment will be decontaminated prior to the start of work, before drilling at each monitoring well boring, and prior to leaving the site after completion of all field activities. Any other vehicle which contacts potentially contaminated material will also be decontaminated. Clean drilling equipment will be kept off the ground on clean sawhorses, racks, or pallets. If blowing dust is

a problem, equipment may be covered with new, clean plastic sheeting. Steam cleaning will be performed using a high temperature, high pressure steam cleaner filled with potable water from the designated source. Liquids and solids generated by steam cleaning will be handled in accordance with Paragraph 4.5 of this FSP.

#### **4.3.1.4 Quality Control**

All field documentation will undergo an internal QC review after the completion of field activities associated with monitoring well drilling and installation. Original field forms will be reviewed by the Project Geologist for completeness, accuracy, and compliance with the FSP and QAPP. Original field forms and any photographic documentation will be stored on-site until completion of the entire field program. Upon completion of the field program, all documentation will be relinquished to the Project Geologist.

#### **4.3.1.5 Documentation**

A complete and accurate log will be prepared for each boring according to the following requirements:

- Logs will be prepared in the field, as borings are drilled, by a qualified, experienced geologist. Each log will be signed by the preparer.
- All log entries will be printed. Photo reproductions will be clear and legible.
- Borehole depth information will be from direct measurements accurate to 0.1 feet.
- Logs will be prepared on the attached sheets (see Figure 4-5).
- All relevant information blanks in the log heading and log body will be completed. If surveyed horizontal control is not available at the time of drilling, location sketches referenced by measured distances or prominent surface features will be shown on or attached to the log.
- Log scale will be 1 inch = 1 foot.
- Each and every material type encountered will be described in column c of the log form. Material types are to be logged directly from samples and indirectly interpolated using professional judgement, drill cuttings, drill action, etc., between sampling intervals.

HTW DRILLING LOG							HOLE NO.		
1. COMPANY NAME				2. DRILLING SUBCONTRACTOR			SHEET 1 OF SHEETS		
3. PROJECT				4. LOCATION					
5. NAME OF DRILLER				6. MANUFACTURER'S DESIGNATION OF DRILL					
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT					8. HOLE LOCATION				
					9. SURFACE ELEVATION				
					10. DATE STARTED		11. DATE COMPLETED		
12. OVERBURDEN THICKNESS				15. DEPTH GROUNDWATER ENCOUNTERED					
13. DEPTH DRILLED INTO ROCK				16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED					
14. TOTAL DEPTH OF HOLE				17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)					
18. GEOTECHNICAL SAMPLES		DISTURBED		UNDISTURBED		19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS		VOC		METALS		OTHER (SPECIFY)		OTHER (SPECIFY)	
								21. TOTAL CORE RECOVERY %	
22. DISPOSITION OF HOLE		BACKFILLED		MONITORING WELL		OTHER (SPECIFY)		23. SIGNATURE OF INSPECTOR	
ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c		FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h	

PROJECT
HOLE NO.

4A-19  
Figure 4-5 Typical Drilling Log

# HTW DRILLING LOG

1 HOLE NO.

PROJECT

INSPECTOR

SHEET  
OF SHEETS

ELEV.  
0

DEPTH  
b

### DESCRIPTION OF MATERIALS

**FIELD SCREENING  
RESULTS**

GEOTECH SAMPLE  
OR CORE BOX NO.

ANALYTICAL  
SAMPLE NO.

## BLOW COUNTS

REMARKS  
1

**PROJECT**

**4A-20**

HOLE NO.

Figure 4-5 (Continued)

- Unconsolidated materials will be described as outlined below and in the following sequence:
  1. descriptive USCS classification in accordance with ASTM D 2488-84;
  2. consistency of cohesive materials or apparent density of non-cohesive materials;
  3. moisture content assessment, e.g., moist, wet, saturated, etc.;
  4. color;
  5. other descriptive features (bedding characteristics, organic materials, macrostructure of fine-grained soils e.g., root holes, fractures, etc.);
  6. depositional type (alluvium, till, loess, etc.).
- Stratigraphic/lithologic changes will be identified in column c by a solid horizontal line at the appropriate scale depth on the log which corresponds to measured borehole depths at which changes occur, measured and recorded to the nearest 0.1 feet. Gradational transitions, changes identified from cuttings, or methods other than direct observation and measurement will be identified by a horizontal dashed line at the appropriate scale depth based on the best judgment of the logger.
- Logs will clearly show in columns e and f, the depth intervals from which all samples are retained.
- Logs will identify the depth at which water is first encountered, the depth to water at the completion of drilling and the stabilized depth to water. The absence of water in borings will also be indicated. Stabilized water level data will include the time allowed for levels to stabilize after drilling activities have ceased.
- Logs will show borehole and sample diameters and depths at which drilling or sampling methods or equipment change.
- Logs will show total depth of penetration and sampling. The bottom of the hole will be identified on the log by solid double lines from margin to margin with the notation "bottom of hole".

- Logs will identify any drilling fluid losses, including depths at which they occur, rate of loss, and total volume lost.
- Logs will show drilling fluids used, including the source of the water.
- Logs will show depths and types of any temporary casing used.
- Logs will identify any intervals of hole instability.
- Any special drilling or sampling problems will be recorded on logs, including descriptions of problem resolutions.
- Logs will include all other information relevant to a particular investigation, including but not limited to:
  1. odors;
  2. PID measurements or other field screening or test results;
  3. any observed evidence of contamination in samples or cuttings.

Daily exploration reports will be completed by the USACE Lead Field Geologist after each days work. These reports serve as an administrative record of the drill crew's daily activities and utilization of equipment. This form will be submitted to the Omaha District Geology Section only for internal use. An example of the form is attached (see Figure 4-6).

A daily quality control report (DQCR) will be completed by the USACE Lead Field Geologist after each days work. These reports will include information on personnel and equipment working at the site, work performed (including samples taken), weather conditions, safety levels (D, modified D, C, etc.) and equipment, quality control activities (such as PID background readings, decontamination procedures), and problems encountered. An example of the form is attached (see Figure 4-7). The DQCR's will be distributed weekly as follows:

- 1 copy to Geology Section: 215 N. 17th St., Omaha, NE 68102-4910, CEMRO-ED-GG Attn: T. Skeen.
- 1 copy for the USACE Lead Field Geologist's files.



## Date of Work \_\_\_\_\_

MRD FORM 074 (Previous Editions May Be Used Until Supply Is Exhausted) 1 AUG 82

# DAILY QUALITY CONTROL REPORT

PROJECT: \_\_\_\_\_

Date: \_\_\_\_\_

LOCATION: \_\_\_\_\_

Weather: \_\_\_\_\_

Temp: \_\_\_\_\_

Wind: \_\_\_\_\_

Humidity: \_\_\_\_\_

## PERSONNEL

Name	Position	Company	Hours Worked

## FIELD INSTALLATIONS

ID No(s): \_\_\_\_\_

Drilled: \_\_\_\_\_

from: \_\_\_\_\_

to: \_\_\_\_\_

Footage: \_\_\_\_\_

Casing Set: \_\_\_\_\_

Screen: \_\_\_\_\_

Riser: \_\_\_\_\_

## EQUIPMENT

Description	Purpose/Use	Time Used

Hours Drilling: \_\_\_\_\_

Hours Installing: \_\_\_\_\_

Hours Decon: \_\_\_\_\_

Hours Development: \_\_\_\_\_

Hours Sampling: \_\_\_\_\_

Hours Shut Down: \_\_\_\_\_

# of Samples: \_\_\_\_\_ Type: \_\_\_\_\_

\_\_\_\_\_

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Description of work performed: \_\_\_\_\_

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Signature: \_\_\_\_\_

Field notes regarding all sampling, field analytical/screening, testing, and instrument calibration activities will be kept by the USACE Lead Field Geologist in a bound notebook with pre-numbered pages. Indelible ink will be used for all entries. If an incorrect entry is made, the information will be lined out with a single strike mark, and the change initialed and dated by the team member initiating the change. Each day's entries will be signed and dated by all persons making entries into that logbook. Information included in the field notebook will include, but not necessarily be limited to, the following:

- Project name
- Date and time
- Sample location (to include bearing and distance measurements as applicable)
- Equipment
- Sample number
- Sample depth
- Sample volume
- Number of aliquots
- Matrix type
- Sampling personnel present
- Type of health and safety clothing/equipment used
- Analyses requested
- Time of sample collection
- Sample preservation, field observations, and soil descriptions (if relative)
- Weather conditions
- Other project-specific information.

In addition, sketches will be made in the field notebook when appropriate, with reference points tied to existing permanent structures in the area (i.e., fence posts, buildings).

#### **4.3.2 Monitoring Well Installation**

##### **4.3.2.1 Introduction**

A maximum of eleven new ground water monitoring wells will be installed at depths ranging from 17 to 60 feet below ground surface (see Figure 4-1 for locations). Actual finished depths will depend on the water table and site stratigraphy as determined in the field by the geologist. Proposed monitoring wells include six wells screened across the water table, and five wells screened in an intermediate portion of the water table aquifer.

#### **4.3.2.2 Equipment**

##### **4.3.2.2.1 Riser**

Well riser will consist of new, 2-inch nominal diameter, schedule 40 PVC pipe conforming to the requirements of ASTM F 480 - 90. All riser sections will be joined by threaded, flush joint couplings to form water tight unions. Adhesives or solvents will not be used to join the casing sections. If a joint seal is questionable, Teflon tape will be used on the threaded joints. Chemically inert "O" rings composed of nitrile are an acceptable option for assuring water tight seals. Lead shot or lead wool will not be used for producing seals at any point in the well.

##### **4.3.2.2.2 Screen**

All well screens will consist of new, 2-inch nominal diameter PVC with continuous-slot (also referred to as continuous-wrap or wire-wrap) design and 0.020-inch slot size. Screen length will be 5 feet for all intermediate wells and 10 feet for all shallow wells. Shorter well screens are being used to limit the amount of dilution potential. No sediment traps will be used to cap the screen bottom. PVC material is specified for the following reasons: mean dissolved oxygen levels in shallow monitoring wells located upgradient of the landfill boundary range from 0.7 to 5.9 milligrams per liter (mg/L) (Duwelius and Silcox, 1991), indicating potentially corrosive conditions, and extremely low levels of organic contamination are expected to be encountered based on the results of previous sampling efforts. Potentially corrosive conditions are also indicated by ground water pH levels less than 7.0 which were sporadically measured across the site during purging for development/sampling, and the mention of hydrogen sulfide gas during development of monitoring well WT111A. Stainless steel well screens can affect the concentrations of metals under corrosive conditions, particularly lead, cadmium, nickel, chromium, and iron (Hewitt, 1994); however, these metals have not been identified as contaminants of concern at the Himco Site. It should be noted that mean dissolved oxygen levels downgradient of the landfill boundary are lower (Duwelius and Silcox, 1991), and the potential for corrosive conditions is significantly lower. PVC materials may be subject to solvation in the presence of organic compounds; however, those chemicals most responsible for the degradation (low molecular weight ketones such as 2-Hexanone) were detected in ground water samples downgradient of the Himco Site at levels currently considered too low to significantly affect either the structural integrity of the screen or chemical quality of the ground water sample.

##### **4.3.2.2.3 Filter Pack**

The annular space around the well screen will be backfilled with clean, well-rounded, washed sand. The filter pack will be composed predominantly of quartz and will contain no more than

5 percent (by weight) calcareous material. The gradation of the filter pack will be 16-30 Colorado Silica Production or equivalent, unless geologic conditions, in the judgement of the geologist, dictates differently. Figure 4-8 shows the gradations of this commercially available filter pack. Filter pack material will extend approximately 1 foot below the bottom of the well screen in all monitoring wells, and extend approximately 1 foot above the top of the well screen in shallow monitoring wells and 2 feet above the top of the well screen in intermediate monitoring wells.

#### **4.3.2.2.4 Bentonite Seal**

A 2-foot thick seal composed of commercially available sodium bentonite will be placed above the filter pack sand. For shallow monitoring wells, the bentonite seal will consist of granular bentonite. The bentonite seal in the intermediate monitoring wells will be composed of pellets which do not exceed 1/2-inch diameter. The thickness of the seal will be measured immediately after placement, without allowance for swelling.

#### **4.3.2.2.5 Annular Seal**

The annular space above the bentonite seal will be filled with grout to within 1 foot of the ground surface for proposed monitoring wells WT113A, WT114A and WT114B, which will have a flush mount completion. The annular space above the bentonite seal in all remaining proposed monitoring wells will be filled with grout to the ground surface. The grout will consist of a mixture of Portland Cement Type I (ASTM C 150 - 89) and water in the proportion of not more than 7 gallons of water from the designated source per bag of cement (94 pounds). Additionally, 3 percent by dry weight of sodium bentonite powder will be added. Other additives or borehole cuttings will not be mixed with the grout. All annular seal materials will be combined in an above-ground rigid container and mixed on site to produce a thick, lump-free mixture.

#### **4.3.2.2.6 Surface Completion**

An 8-inch diameter flush mount monitoring well protector with 12-inch protective cover pipe (skirt) will be installed above the annular seal for monitoring wells WT113A, WT114A and WT114B. These wells are to be completed as flush mount wells as they will be located on a grassy strip immediately adjacent to Nappanee Street Extension where they might interfere with mowing operations. All remaining monitoring wells will be completed above ground. The flush mount protective casing will be installed in a manner that does not hinder access to the monitoring well for purposes of taking ground water samples or water level measurements. The lid will be watertight and secured by bolts. A concrete ground surface seal will be installed that completely fills the annular space between the skirt and the borehole wall, and extends to the base of the skirt. A flush mount cement pad approximately 2 feet square and 4 inches thick will be

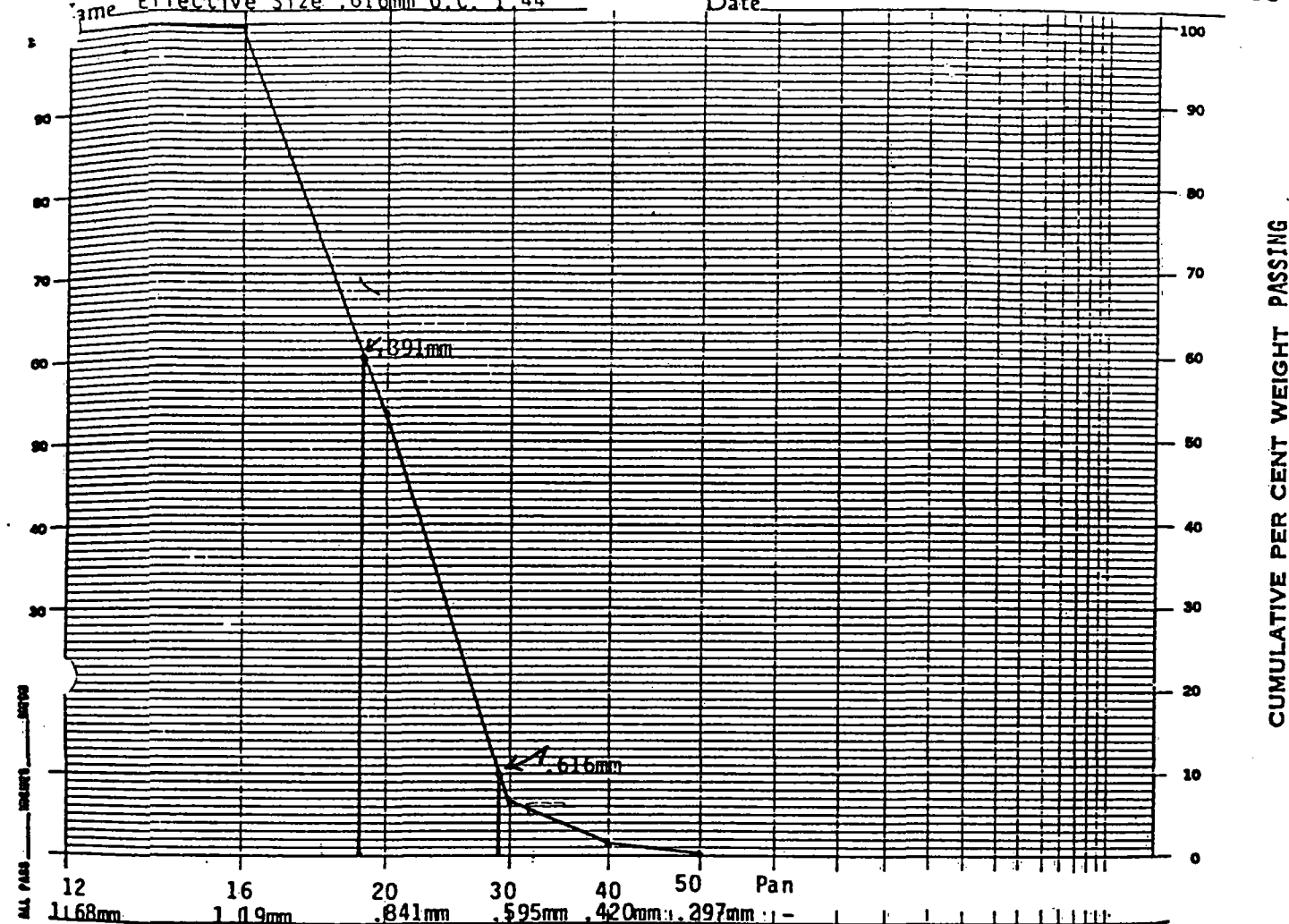
Form No. L-8  
Please mention above  
when ordering

Cumulative Direct Diagram of Screen Analysis on Sample of \_\_\_\_\_ 16-30 Production

Effective Size .616mm U.C. 1.44

Date \_\_\_\_\_

**L-8**

[illegible]

		Totals.							
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N PLOTTING SQUARE ROOT OF TWO SERIES USE EVERY OTHER VERTICAL LINE W. S. TYLER, INCORPORATED, OHIO, MENTOR, 44060 U.S.A. 2-85

**4A-28**

**Figure 4-8** Filter Pack Gradation Sheet for Colorado Silica 16-30  
Production Sand

constructed around the ground surface seal, and will be sloped away from the well. The ground immediately surrounding the cement pad will be smoothed out such that it slopes away from the well. The well riser will be cut off below ground surface such that the top of the well riser is no more than 8 inches below the top of the protective cover. The top of the flush mount protector will project no more than 1/2 inch above the surrounding ground surface.

Wells to be completed above ground will have the riser cut off approximately 2.5 feet above the surrounding ground surface. The well riser will be surrounded by a 4-inch diameter (or 4-inch square), 5-foot long steel casing with hinged locking top which will be set approximately 2.5 feet into the annular seal. A 1/8-inch diameter drainage hole will be drilled into the outer protective casing just above the level of the bentonite-cement grout which occupies the space between the protective casing and the well riser. A minimum 3-foot square by 4-inch thick concrete pad, sloped away from the well, will be constructed around the well casing with the top outer edge at the final ground level elevation. Three 2-inch diameter steel posts will be equally spaced around the well and cemented in place outside the concrete pad. The ground surface immediately surrounding the top of the well will be sloped away from the well. The outside of all above ground casings and protective posts will be painted orange.

A suitable vented slip cap will be installed on the riser of all above ground wells and a weathertight locking cap will be installed on all flush mount wells to prevent material from entering the wells. A lock will be installed on the flush mount well cap and protective casing for all new monitoring wells. All locks will be brass and keyed alike. One set of keys will be kept by the USACE Project Geologist, and one set will be provided to the EPA Remedial Project Manager.

#### **4.3.2.2.7 Well Identification**

A permanent corrosion resistant tag will be affixed to the inside of the protective cover lid of each new flush mount monitoring well, and on the outside of the protective casing of each new above ground monitoring well. Each tag will clearly identify the type of well (ground water monitoring well), well number, depth to bottom of well, date of installation, the U.S. Army Corps of Engineers, Omaha District, and the adjusted top of riser elevation. These tags will be affixed to the wells following field surveying to allow for the elevation to be included on the tag.

#### **4.3.2.3 Procedures**

##### **4.3.2.3.1 Well Installation**

At all times during the progress of work, precautions will be taken to prevent tampering with the

wells or entrance of foreign material into them. Run-off will be prevented from entering the wells during construction. Any well left incomplete due to a delay in construction will be capped with a watertight locking cap and lock.

All well materials will be steam cleaned on site immediately before installation, and will remain clean until installed in the boring, or the material will be steam cleaned again.

The volume of the filter pack, bentonite seal, and annular seal materials required to fill the space between the well riser and borehole wall will be predetermined prior to emplacement. This is particularly important for the filter pack or bentonite material to ensure that bridging has not occurred.

The shallow monitoring well borings will initially be backfilled with approximately 1 foot of filter pack. Screen and riser will then be set through the HSA into the borehole, and hung such that the well screen is not allowed to rest on the bottom. Screens will be placed across the water table such that 7 feet is submerged below and 3 feet is above the water table. The screen and riser will be kept centered within the HSA at all times, and will be set round, plumb, and true to line. No centralizers will be used. Filter pack material will then be placed around the well screen in shallow monitoring wells by pouring the material down the annulus between the augers and riser/screen. Placement by the freefall method does not cause segregation of the filter pack where the uniformity coefficient (UC) is less than 2.5 (Aller et al., 1989). The UC of the specified filter pack is 1.44. Placement of the filter pack will proceed slowly to avoid bridging and insure a continuous filter pack throughout the screened interval of the well. The depth to the top of the filter pack will be checked frequently with a weighted measuring tape. Filter pack material will extend approximately 1 foot above the top of the well screen. The bentonite seal will be placed in shallow aquifer wells in 6-inch lifts, with each lift hydrated a minimum of 30 minutes between lifts before proceeding. The last lift will be allowed to hydrate a minimum of 12 hours (overnight) prior to placing the annular seal. Bentonite material will also be poured down the annulus between the augers and riser/screen. Clean potable water from the designated source will be used to hydrate the bentonite. Grout will also be placed by pouring it down the annulus between the augers and well casing.

Intermediate monitoring well screens will be placed to monitor the aquifer at approximately 60 feet below the ground surface (approximate depth to bottom of screen). Methods and procedures for construction of the intermediate monitoring wells will be similar to that for the shallow monitoring wells, with the following exceptions. Filter pack material will extend approximately 2 feet above the top of the well screen and will be placed by a 1 1/2-inch nominal diameter or greater tremie pipe in order to reduce the chances of bridging. Bentonite seal material will be placed in one lift with a minimum thickness of 2 feet. The bentonite seal will be hydrated a



minimum of 12 hours (overnight) before grouting begins. As the annular space between the auger and well riser will be less than 3 inches, the bentonite pellets will be placed using a 2-inch nominal diameter tremie pipe. Grout will be placed by pumping through a side discharge tremie pipe. The lower end of the tremie pipe will initially be placed within 3 feet from the top of the bentonite seal, and may be moved during grouting such that the lower end of the tremie pipe is a minimum of 5 feet below the top of the grout column as it rises. Pumping will continue until undiluted grout fills the annular space to approximately 12 inches below ground surface for a flush mount well, or to ground surface for an above ground completion.

The formation material adjacent to the borings for all monitoring wells will be noncohesive and the boreholes are not expected to stand open. As a result, the augers will be slowly removed from the borehole as materials are placed into the annular space between the riser and borehole wall. Clean water from the approved source may be added to the boring while installing the filter pack material to maintain a positive pressure head in the auger column. This should prevent collapse of the formation.

Surface completion will be done in accordance with Paragraph 4.3.2.2.6 of this FSP after the bentonite-cement grout that forms the annular seal sets.

#### **4.3.2.3.2 Well Plumbness and Alignment**

A 5-foot long section of pipe, 1/2-inch less in diameter than the minimum diameter of the well riser and screen, will be passed through the entire length of all newly installed wells to check their alignment. The result of each test will be recorded by the geologist on the appropriate well construction diagram. If the pipe does not pass freely through the entire length of a well, then the well will be replaced or repaired. The pipe will be decontaminated with steam prior to and immediately after the test. Adequate precautions will be taken to prevent cross-contamination of the wells by changing the rope attached to the pipe prior to each plumbness and alignment test.

#### **4.3.2.3.3 Well Development**

Within 1 week after each well has been constructed, and no sooner than 48 hours after grouting is completed, each well will be developed without the use of dispersing agents, acids, or explosives. Existing monitoring wells WTD3, WTE1, WTO1, WT101A, WT101B, WT102A, WT102B, and WT111A will also be redeveloped. The objectives of well development are to a) assure that ground water enters the well screen freely, thus yielding representative ground water samples and accurate water level measurements, b) remove all water that may have been introduced during drilling and well installation, c) remove very fine-grained sediment in the filter pack and nearby formation so that ground water samples are not highly turbid and silting of the

well does not occur.

Development will consist of mechanical surging and pumping until little or no sediment enters the well. For monitoring wells WTD3 and WTE1 which have 5-inch diameter casing/screen, development will be accomplished using the drill rig and a 4-inch diameter surge block attached to the end of the drill rods. A 4-inch diameter sand pump (a type of bailer) will be used to remove fines which have entered the screen, and a 3.5-inch Grundfos submersible pump will be used for pumping. For the remaining monitoring wells, surging will be accomplished with the use of a QED Well Wizard positive displacement pump with surge rings attached so that surging and pumping may be performed concurrently. Should this method prove to be ineffective or inadequate, then a bailer will be used to surge and evacuate the well instead.

Any sediments brought into the wells during development will be removed. Surging and pumping/bailing will continue for a minimum of 2 hours. At the end of that time, the wells will be continuously pumped using the QED Well Wizard or Grundfos. Temperature, pH, specific conductivity, dissolved oxygen, and nephelometric turbidity will be monitored by the geologist at a minimum rate of 1 reading per well volume of water removed, and will be taken immediately prior to and during all development activities. Continuous pumping will take place until these parameters have stabilized (less than 0.2 pH units and a 10% change for the other parameters between four consecutive readings) and the water is clear and free of fines. Turbidity is the most critical parameter to monitor during well development. The standard to aim for in well development will be 5 nephelometric turbidity units (NTUs). If these parameters have not stabilized and/or turbidity measurements are greater than 5 NTUs after 4 hours of continuous pumping, then the USACE Project Geologist will be contacted for further direction.

If the addition of water is required to facilitate surging and pumping/bailing, only formation water from that well will be used. If this is not practical due to the tightness of the formation, then only bailing will be done. In all cases, the utmost care will be taken not to collapse well screens during development activities, and at least 2 to 3 times the water introduced during drilling will be removed from each well.

Approximately 1 liter of the last water withdrawn from the well during development will be collected in a clear glass jar, labeled, and immediately photographed by the geologist with a 35 mm color photo. The photograph will be a suitably back-lit close up which shows the clarity of the water, and will be submitted as part of the well development record. Fines remaining in the water will not be allowed to settle out prior to taking the photograph. The depth of any sediment which collects in the bottom of the jar after the sample is allowed to settle will be noted on the record of well development. The nephelometric turbidity of the water will be determined by the geologist and shown on the final well development record.

All development water generated from the monitoring wells will be handled according to the procedures outlined in Paragraph 4.5 of this FSP.

#### **4.3.2.3.4 Well Abandonment**

Before abandoning any monitoring well, all debris or obstructions will be removed. Cement-bentonite grout will be used to plug the well. The grout mixture will consist of Portland Cement Type I and water in the proportion of not more than 7 gallons of water per bag of cement (94 pounds) and 3 percent by weight sodium bentonite powder. The grout will be placed by pumping it through a bottom discharge tremie pipe with the lower end of the tremie pipe located within 3 feet of the well bottom. Pumping will continue until the undiluted grout level is within 2 feet of the ground surface. Any concrete surface pad and/or protective cover or posts will be removed, and the riser cut off 2 feet below ground surface. The remainder of the hole will be backfilled with compacted soil.

#### **4.3.2.4 Equipment Decontamination**

Decontamination of all drilling equipment to be used for monitoring well installation will follow the guidelines established in Paragraph 4.3.1.3 of this FSP. Well development equipment will be decontaminated in accordance with Paragraph 4.2.3 of this FSP. Liquids and solids generated by the decontamination process will be handled in accordance with Paragraph 4.5 of this FSP.

#### **4.3.2.5 Quality Control**

All field documentation will undergo an internal QC review after the completion of field activities associated with monitoring well installation and development. Original field forms will be reviewed by the Project Geologist for completeness, accuracy, and compliance with the FSP and QAPP. Original field forms and any photographic documentation will be stored on-site until completion of the entire field program. Upon completion of the field program, all documentation will be relinquished to the Project Geologist.

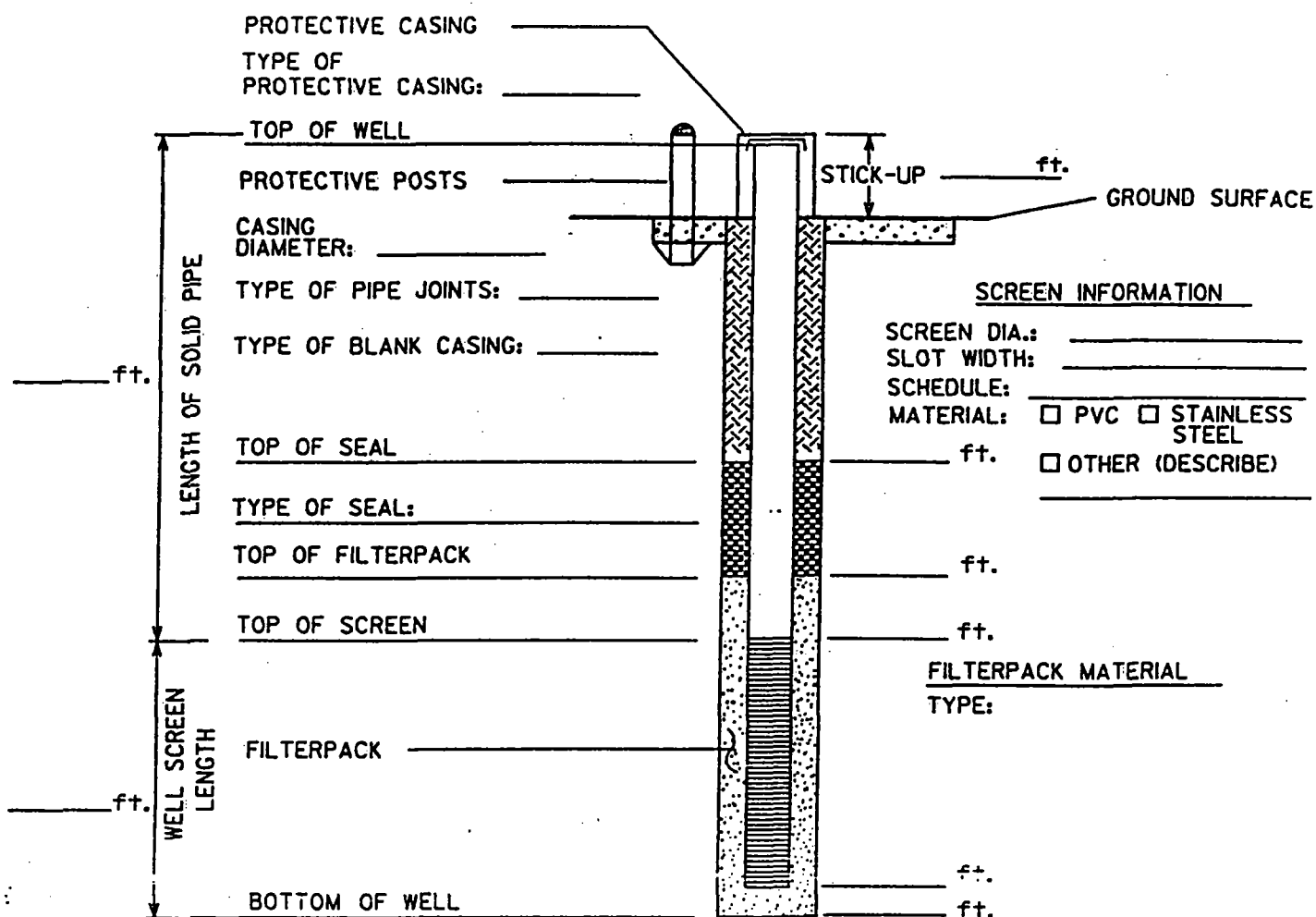
#### **4.3.2.6 Documentation**

Suitable diagrams detailing construction practices of all wells will be maintained by the Lead Field Geologist during all well construction operations. Examples of the diagrams are attached (see Figures 4-9 and 4-10). Information provided on well construction diagrams will include, but not be limited to the following:

HOLE NO. (as shown on drawing title and file number)	PROJECT
DATE INSTALLED	LOCATION (Coordinates or Station)
ELEVATION TOP OF HOLE	SIGNATURE OF INSPECTOR/INSTALLER
DRILLING METHOD	ELEVATION GROUND WATER (or depth from surface)

## WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)

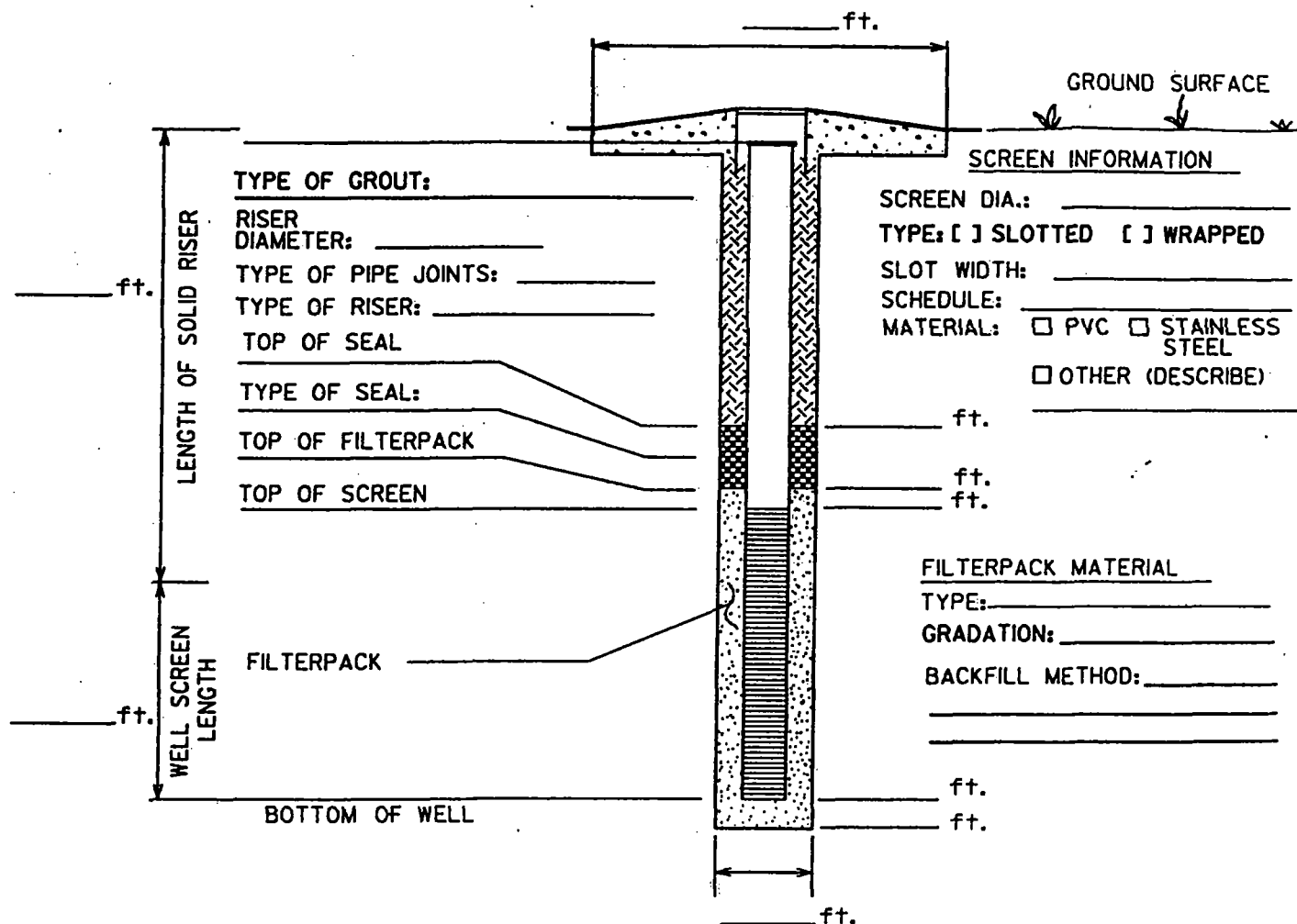


**Figure 4-9** Typical Monitoring Well Construction Diagram for Above Ground Wells

ELEVATION GROUND WATER			PROJECT
DATE INSTALLED	STARTED	COMPLETED	LOCATION (Coordinates or Station)
ELEVATION TOP OF HOLE			SIGNATURE OF INSPECTOR
TOTAL DEPTH OF HOLE			WELL NO.

## FLUSH MOUNT WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)



### WATER LEVEL SUMMARY

#### WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

- Project and site names, well number and the total depth of completed well.
- Hole diameters and depth at which the hole diameter changes.
- Depth of any grouting or sealing, and the amount of cement and/or bentonite used.
- Type and lengths of well casing.
- Static water level upon completion of the well and after well development.
- Installation date or dates, and name of the driller and the geologist installing the well. Each installation diagram will be signed by the preparer.
- All pertinent construction details of monitoring wells, such as depth to and description of all backfill materials installed (such as gravel pack, bentonite, and grout); gradation of gravel pack; length, location, diameter, slot size, material (PVC, etc.), and manufacturer of well screen(s); location of any blank pipe installed in the well; use of Teflon tape or "O" rings for joint seals; and stick-up (or stick-down) of the riser.
- Description of surface completion, including protective steel casing, protective pipes, and concrete surface seal.
- A description of any difficulties encountered during well construction, and PID readings.
- Survey coordinates, and elevation of top of ground and top of well casing.
- Results of well alignment test.

A well development record will be prepared and completed for each monitoring well installed (Figure 4-11). The record will be prepared by the geologist present during all well development operations. Information provided on the well development record will include, but not be limited to the following:

- Name of project and site, well identification number, and date(s) of development.
- Date, time, and depth to the static water level and bottom of well/top of sediment before development.

# USACE WELL DEVELOPMENT RECORD

## SITE & WELL DATA

Project:	Well Number:
Location:	TOC Elevation:
Well Coordinates:	Ground Elevation:
Date Well Installed:	Installed Well Depth (TOC):
Date Well Developed:	Screened Interval (TOC):
Fluid Losses During Drilling:	Casing Diameter:

## DEVELOPMENT DATA

<input type="checkbox"/> Initial Development <input type="checkbox"/> Redevelopment		Weather Conditions:
Static Water Level (TOC): Initial: _____ Time: _____ Final: _____ Time: _____		Post Development Water: Jar Photographed <input type="checkbox"/> Yes <input type="checkbox"/> No  *Measured Sediment Thickness in Jar: _____
Sounded Depth (TOC): Initial: _____ Time: _____ Final: _____ Time: _____		
Development Start: Date: _____ Time: _____		Development Finish: Date: _____ Time: _____

Development Method (Completely describe development method to include all equipment and procedures):

Misc. Notes:

Submerged Volume Calculation:

One Submerged  
Volume:

Time	Pump Rate ( )	Volume Removed ( )	pH	Temp. ( )	Turb. (ntu)	Cond. ( )	D.O. ( )	Eh ( )	Remarks (Color, odor, etc.)

Name:	Firm:
Signature:	Date: _____ Page <u>1</u> of _____

## USACE WELL DEVELOPMENT RECORD

## SITE & WELL DATA

**Project:**

**Well Number:**

**Location:**

**TOC Elevation:**

### DEVELOPMENT DATA (CONT.)

**Misc. Notes:**

[illegible]

**Name:**

**Firm:**

**Signature:**

**Date:**

Page \_\_\_\_\_ of \_\_\_\_\_



- Method used for development, to include equipment size, type, and make of bailer and/or pump used during development.
- Time spent developing the well by each method, to include the typical pumping rate if a pump was used in development.
- Volume and physical character of water removed, to include changes during development in clarity, color, particulates, and odor.
- Volume and source of any water added to the well.
- Volume and physical character of sediment removed, to include changes during development in color and odor.
- Clarity of water before, during, and after development, including a backlit photo, measurement of nephelometric turbidity, and depth of any sediment which settles to the bottom of the jar containing the last one liter of water withdrawn from the well during development.
- Date, time, and depth to the static water level and bottom of well/top of sediment immediately after, and 24 hours after development.
- Readings of pH, specific conductance, temperature, and nephelometric turbidity taken before, during, and after development, and time of readings.
- Name(s) and job title of individual(s) developing well.

### **4.3.3 Water Level Measurements**

#### **4.3.3.1 Introduction**

A complete round of ground water elevation measurements will be obtained from all newly installed and existing monitoring wells. This site-wide ground water elevation survey will be conducted no sooner than 2 weeks after development activities have been completed on all monitoring wells, and immediately prior to the ground water sampling event outlined in Paragraph 4.3.4 below. A total of 38 wells will be measured, including the 27 existing wells in Table 4-2 and the 11 newly installed wells. Measurements from all wells will be completed within the smallest time frame possible (maximum 8-hour period) to reduce external variables such as weather conditions.

#### **4.3.3.2 Equipment And Procedures**

Prior to taking any water level measurements, the outer protective cover/casing and inner casing/well cap will be inspected for any signs of tampering. If there is evidence of tampering, or a lock is missing, then this will be recorded in the field record sheet. The well cap will be removed and a headspace reading will be taken with a PID instrument. All monitoring wells with a watertight cap will be allowed to sit for approximately 1/2 hour prior to taking any water level measurements. This will enable the water level to stabilize. The next step will be to measure the water level in the well using an electronic water level meter. Measurements will be taken to the nearest 0.01 feet. After determining the water level, the probe will be lowered to the bottom of the well to measure total depth of the well. Any sheen or odor from the probe will be noted on the record sheet for that well. All monitoring wells with a watertight cap will be rechecked no sooner than one hour after the initial water level reading to ensure that water levels have stabilized in those wells.

#### **4.3.3.3 Equipment Decontamination**

Water level measuring equipment will be decontaminated in accordance with Paragraph 4.2.3 of this FSP. Liquids generated by the decontamination process will be handled in accordance with Paragraph 4.5 of this FSP.

#### **4.3.3.4 Quality Control**

All field documentation will undergo an internal QC review after the completion of field activities associated with the site-wide ground water elevation survey. Original field forms will be reviewed by the Project Geologist for completeness, accuracy, and compliance with the FSP and QAPP. Original field forms and any photographic documentation will be stored on-site until completion of the entire field program. Upon completion of the field program, all documentation will be relinquished to the Project Geologist.

#### **4.3.3.5 Documentation**

Data collected will be recorded on standard field record sheets (Figure 4-12). A separate data sheet will be completed for each well. At a minimum, the following data will be recorded when water level measurements are taken: date, time of measurement, well number, water level, well depth, weather conditions at time of measurements, and any observations as pointed out above.

# FIELD RECORD OF WELL GAUGING, PURGING, AND SAMPLING

Project: \_\_\_\_\_ Site: \_\_\_\_\_

Well No: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Weather: \_\_\_\_\_

Well Condition: \_\_\_\_\_

Stick up/down (ft): \_\_\_\_\_ Well Diameter (in.): \_\_\_\_\_

Odor (describe): \_\_\_\_\_

Sounding Method: \_\_\_\_\_ Measurement Reference: \_\_\_\_\_

(1) Well Depth (ft): \_\_\_\_\_ Purge Date: \_\_\_\_\_ Time: \_\_\_\_\_

(2) Depth to Liquid (ft): \_\_\_\_\_ Purge Method: \_\_\_\_\_

(3) Depth to Water (ft): \_\_\_\_\_ Purge Rate: \_\_\_\_\_

(4) Liquid Depth [(1) - (2)]: \_\_\_\_\_ Purge Time: \_\_\_\_\_

(5) Liquid Volume: \_\_\_\_\_ Purge Volume: \_\_\_\_\_

Sample	Time	pH	Cond.	Temp.	Turb.	Remarks (sed., color, clarity, etc.)
Initial						
Final						

Did Well Pump Dry? Describe: \_\_\_\_\_

Samplers: \_\_\_\_\_ Sampling Date: \_\_\_\_\_

Sample Types: \_\_\_\_\_

Remarks: \_\_\_\_\_

#### **4.3.4 Ground Water Sampling**

##### **4.3.4.1 Introduction**

After development, all monitoring wells will be allowed to stabilize for a minimum of 2 weeks prior to sampling. Concurrent with ground water sampling of newly installed monitoring wells, ground water sampling will be conducted on existing monitoring wells WTD3, WTE1, WTO1, WT101A, WT101B, WT102A, WT102B, and WT111A. All ground water samples will be analyzed for VOCs, SVOCs, Pesticides/PCBs, and Metals.

##### **4.3.4.2 Equipment and Procedures**

Before beginning the ground water sampling process, field meters will be calibrated in accordance with the Standard Operating Procedures (SOPs) found in Attachment 1 of the QAPP Addendum. Results of meter calibrations will be recorded in the project field logbook. Procedures for field screening measurements may also be found in Attachment 1 of the QAPP Addendum.

Before a sample is collected from any well, the water level and total well depth will be measured and recorded following the procedures outlined above in Paragraph 4.3.3.2. The well will then be pumped using a Grundfos Redi-Flow II submersible pump with dedicated Teflon-lined polyethylene tubing to remove a quantity of water equal to at least three times the submerged volume of the casing.

The well will be pumped at a rate that does not cause ground water to vigorously cascade down the sides of the screen, potentially causing accelerated loss of volatiles. A flow rate not to exceed the well recovery rate and/or the well development rate will be used when purging, and a target rate of 100 ml/minute will be used for sampling. The same parameters as specified in Paragraph 4.3.2.3.3 (Well Development) will be measured and recorded during the purging process. Field parameters will be measured at the start of purging, and a minimum of once per casing volume removed. Purging will continue beyond three casing volumes until these parameters have stabilized (0.2 pH units and a 10 percent change for the other parameters between four consecutive readings). If a low yielding well dewateres before evacuation of the required volume, the well will be allowed 30 minutes to recover, and pumping will be resumed. If the well again goes dry, pumping will cease, and the volume purged will be recorded. Ground water sampling will occur as soon as sufficient quantity of water is available.

Samples will be collected, labeled, and placed in the proper types of containers as specified in the previously approved FSP (Donohue, 1990). The order of collection will be:

1. Volatile Organic Compounds (VOCs)
2. Semi-Volatile Organics (SVOCs)
3. Pesticides/PCBs
4. Metals

Sampling for VOCs requires special care not to agitate the sample and promote volatilization. In addition, no headspace may be present in the sample container after it has been filled. VOC samples will be collected using a slow controlled pour down the inside of a tilted VOA container to minimize agitation. The sample container will be filled until the meniscus is above the top of the container. The sample bottle will be capped, then inverted and tapped lightly upon the back of the sampler's hand to determine if any air bubbles are trapped within the container. Containers with trapped air will be discarded and a new sample bottle will be filled.

Appropriate preservatives will be added to any samples that require them at the time of collection, as specified in the previously approved FSP (Donohue, 1990). Samples preserved with acid will be checked with pH paper of the proper sensitivity to ensure correct pH levels have been obtained.

Sample bottles will then be placed in a cooler with a temperature of 4°C, and a chain-of-custody form will be filled out. The temperature inside the cooler will be maintained by the use of bagged ice. Sample packaging and shipment is specified in the previously approved FSP (Donohue, 1990). All purge water generated from the monitoring wells will be handled according to the procedures outlined in Paragraph 4.5 of this FSP.

#### **4.3.4.3 Equipment Decontamination**

All non-dedicated ground water sampling equipment will be decontaminated between wells in accordance with Paragraph 4.2.3 of this FSP. The sampling pump will be disassembled and the individual parts will be decontaminated separately. Liquids generated by the decontamination process will be handled in accordance with Paragraph 4.5 of this FSP.

#### **4.3.4.4 Quality Control**

Ground water samples will be collected and analyzed for the purpose of assessing the quality of the sampling effort and the analytical data. QC and QA samples will include duplicates of field samples, rinsate blanks, and trip blanks. All QA/QC samples to be collected are listed in Table 4-1. Additional volume requirements for laboratory matrix spike/matrix spike duplicate (MS/MSD) samples are also shown in Table 4-1.

Field duplicates will be collected as separate grab samples obtained consecutively from a given sampling location. Field duplicates will be collected at a frequency of one per every ten field samples collected. Duplicate samples will be obtained from both the shallow and intermediate portions of the aquifer.

Rinsate blanks will be collected from the sampling equipment after the decontamination procedure has been performed by pumping deionized water through the sampling pump and collecting the water in the appropriate containers as outlined in Table 6-2 of the QAPP Addendum. Rinsate blanks will be taken at a frequency of one per every ten field samples collected.

Trip blanks will be shipped to and from the field with the sample containers, and will not be opened by the field sampling personnel. Trip blanks will be shipped back to the laboratory at a frequency of one per cooler of aqueous samples for VOC analysis per day.

All field documentation will undergo an internal QC review after the completion of field activities associated with the site-wide ground water elevation survey. Original field forms will be reviewed by the Project Geologist for completeness, accuracy, and compliance with the FSP and QAPP. Original field forms and any photographic documentation will be stored on-site until completion of the entire field program. Upon completion of the field program, all documentation will be relinquished to the Project Geologist.

#### **4.3.4.5 Documentation**

Data collected during ground water sampling activities will be recorded on standard field record sheets (Figure 4-12). A separate data sheet will be completed for each sampling location.

### **4.4 Soil Gas Sampling**

#### **4.4.1 Introduction**

The purpose of the soil gas survey at the Himco Dump Site is to quantify methane gas generation rates. The survey shall include the entire landfill, and will extend approximately 50 feet beyond the landfill limits. It is estimated that approximately 77 sample locations will be required to adequately determine methane production within the landfill (sample locations are shown on Figure 4-2). Upon completion of the field work, gas sample concentrations shall be used to calculate methane generation rates at each point on the sampling grid. These values will be integrated over the sampling area to give an estimate of the annualized methane generation rate for the entire landfill.

#### **4.4.2 Equipment and Procedures**

A GEO Group GA-90 Infrared Gas Analyzer will be used to measure real-time concentrations of methane. The sampling procedure shall consist of multiple timed withdrawals of soil gas from embedded copper tubing collection pipes. Collection pipes will be hand driven using a probe driver to a depth of approximately 18 inches. The pipes will then be sealed with a polyethylene stop-cock release mechanism. Prior to taking a measurement, the analyzer will be calibrated to zero against the ambient air. Calibration will be in accordance with the SOP found in Attachment 2 of the QAPP Addendum. Results of meter calibrations will be recorded in the project field logbook. The gas analyzer will then be connected directly to the stop-cock, the stop-cock opened, and a reading will be taken in accordance with the field screening measurement SOP which may be found in Attachment 2 of the QAPP Addendum. Sampling will occur approximately every four hours over a twenty four hour time period until a total of 6 measurements have been obtained at each location. After each sampling event, the stop-cock will be closed and the field instrument detached, then allowed to return to equilibrium with the ambient air until the meter indicates a reading of zero. It should take no longer than 20 seconds for the field instrument to return to equilibrium.

Field work will include one or more two-person teams. The team(s) will transport system components and support equipment to the site, set stakes at each sampling location, then deploy the collection pipes. One member of each team is designated "clean" and given exclusive responsibility for procedures involving components which must be protected from contamination. The team leader will be responsible for recording the survey point location code, date and time of emplacement, and other relevant information. Upon completion of the soil gas sampling, field personnel will ensure that all survey locations remain staked and the location number is readily visible on the stake.

#### **4.4.3 Equipment Decontamination**

Prior to any use, each collection tube will be cleaned with an absorbent, wrapped, and stored in a caustic solution of sodium hydroxide to assure that no methane is present before sampling. The gas analyzer will be decontaminated between sampling by purging it with ambient air until it reaches a reading of zero. After sampling is completed, the pipes will be removed and the holes collapsed. All sampling equipment which has come into contact with contaminated soil or wastes will be decontaminated in accordance with Paragraph 4.2.3 of this FSP. Liquids generated by the decontamination process will be handled in accordance with Paragraph 4.5 of this FSP.

#### **4.4.4 Quality Control**

All field documentation will undergo an internal QC review after completion of field activities associated with the soil gas sampling. Original field forms will be reviewed by the Project Geologist for completeness, accuracy, and compliance with the FSP and QAPP. Original field forms and any photographic documentation will be stored on-site until completion of the entire field program. Upon completion of the field program, all documentation will be relinquished to the Project Geologist.

#### **4.4.5 Documentation**

All documentation pertaining to the soil gas sampling will be entered in the project field logbook. Field documentation will include, at a minimum, the date, time and location of the sample collected, the sample identification number, field meter instrument calibration, whether or not the soil is wet from rain or other sources of water, unusual sampling conditions, and any problems encountered while obtaining the sample which could affect the sample quality.

#### **4.5 Investigation Derived Waste**

This paragraph addresses the procedures for handling wastes generated during all field activities. All 55-gallon drums used for storing waste products will be new, U.S. DOT approved for hazardous waste. All drums will be sealed and secured on wooden pallets at the designated staging area when filled. This will be done on a daily basis as necessary. The staging area will be located behind the central decon area in the southeast portion of the site. Labeling will be of a permanent nature, and will be placed on the side of the drum. Drums will be positioned during staging such that labels are easily viewed. Specific information to be provided on drum labels includes: site, type of material, date of collection, and the U.S. Army Corps of Engineers, Omaha District. This information will also be recorded in the field notebook. The USACE Omaha District will dispose of all investigation derived waste upon completion of field activities.

Drill cuttings from monitoring well borings located in an uncontaminated area (WT112A, WT112B, WT113A, WT114A, and WT114B) will be scattered on the ground immediately adjacent to the borehole. Drill cuttings from the first five feet of the remaining monitoring well borings will be collected in 55-gallon drums and transported to the landfill, where they will be disposed of by neatly shoveling them on the ground surface within the landfill boundary. Drill cuttings obtained from below 5 feet will be scattered on the ground immediately adjacent to the borehole. Sediment from the decontamination pad will be dewatered and containerized separately in 55-gallon drums.



All water removed for development and sampling, and from the decontamination pad and buckets will be containerized in 55 gallon drums or a 500-gallon polyethylene tank, and transported to a 20,000-gallon frac tank where it will be transferred to. Upon completion of all field activities, a bulk sample will be obtained from the frac tank for analysis. Depending on the analytical results, the water may be disposed of at a publicly operated treatment works.

Other wastes generated during decontamination activities, including discarded PPE, disposable sampling equipment (tubing, rope, etc.), plastic, aluminum foil, and other debris, will be collected and containerized in 55-gallon drums.

#### **4.6 Surveying**

All newly installed and existing monitoring wells that will be used either for the ground water elevation survey, as part of the monitoring well network to be sampled, or both will be surveyed for horizontal and vertical control.

Coordinates will be to the closest 1 foot, and referenced to the North American Datum (NAD) of 1983 or 1927, and the State Plane Coordinate System. A ground elevation to the closest 0.1 foot, and an elevation for the top of the riser to the closest 0.01 foot will be obtained for each well. These elevations will be referenced to Mean Sea Level, specifically the National Geodetic Vertical Datum (NGVD) of 1988. If the 1988 Datum is not available, then the NGVD 1929 Datum will be used.

Field equipment will include direct reading levels and level rods, transits, steel tapes incrementally marked to hundredths of a foot, and other necessary equipment including, but not limited to, plumb bobs, paint, stakes, and nails. All surveying activities will be recorded in bound field notebooks.

Vertical control will be established through level runs to establish surface elevations with respect to known benchmarks. Level runs will be tied back into initial control points as a check on closure.

Horizontal control will be established through traverse runs. Horizontal traverses will be tied into permanent benchmarks. Horizontal traverse runs will be tied back into initial control points as a check for closure.

## **5.0 SAMPLE IDENTIFICATION NUMBERS AND DOCUMENTATION**

Sample identification numbers and documentation will be the same as those in the previously approved FSP (Donohue, 1990) with the following exceptions:

- Sample documentation will not include the Special Analytical Services (SAS) Packing List or the Central Regional Laboratory (CRL) Sample Data Report.
- Chain of Custody forms are included on the Traffic Reports.
- Field sample identification numbers may be found in Figures 4-1 and 4-2 of this FSP.
- The sample number for all samples will reflect a suffix of -03, indicating the third sampling event under this QAPP

## **6.0 CHAIN OF CUSTODY**

Chain of custody procedures will be the same as those in the previously approved FSP (Donohue, 1990) with the exception that the Lead Field Geologist will be responsible completing all chain of custody forms and seals.

## **7.0 PACKAGING AND SHIPPING**

Packaging and shipping procedures will be the same as those in the previously approved FSP (Donohue, 1990) with the exception that the USACE Lead Field Geologist will notify RUST of the sample shipments. RUST will be responsible for notifying the USEPA Region 5 Sample Management Office (SMO or CLASS) and Contract Analytical Support Section (CASS) of all sample shipments.

At the time all samples are packaged, a call from the field to RUST should occur. The lead field geologist should identify the samples that will be shipped and the number of coolers. This phone call should be made no later than 2:00 pm to Mr. Greg Ruechel, RUST Chemist, at (414) 451-2522. Following this call, the Traffic Report/Chain of Custody should be faxed to RUST at (414) 458-0550. Samples that will be sent on Friday for Saturday delivery can only be shipped to the selected laboratory during the first week that USEPA has assigned a case number (first week of the two week increment). On this first Friday, the phone call to RUST should occur no later than 12:00 pm.

## **8.0 REFERENCES**

- Aller, L., Bennett, T.W., Hackett, G., Petty, R.J., Lehr, J.H., Sedoris, H., Nielsen, D.M., Denne, J.E., 1989, EPA 600/4-89/034, Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells, National Water Well Association, Dublin, Ohio, p. 210.
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- Environmental Protection Agency, 1993, Record of Decision, Himco Dump Site, Elkhart, Indiana.
- Hewitt, Alan, 1994, Dynamic Study of Common Well Screen Materials, Groundwater Monitoring and Remediation, Vol. 14, No. 1, pp. 87-94.
- SEC Donohue, 1992, Final Remedial Investigation Report, Himco Dump Remedial Investigation/Feasibility Study, Elkhart, Indiana.
- SEC Donohue, 1990, Field Sampling Plan, Himco Dump Remedial Investigation/Feasibility Study, Elkhart, Indiana.

**APPENDIX B**  
**QUALITY ASSURANCE PROJECT PLAN (QAPP)**  
**(RUST Engineering)**

**FINAL**

**ADDENDUM**  
**TO THE**  
**FINAL QUALITY ASSURANCE PROJECT PLAN**  
**FOR**  
**REMEDIAL DESIGN/REMEDIAL ACTION FIELD ACTIVITIES**  
**AT THE**  
**HIMCO DUMP SUPERFUND SITE**  
**ELKHART, INDIANA**

**Prepared for:**

**United States**  
**Environmental Protection Agency**  
**Region 5**  
**Chicago, Illinois**

**Prepared by:**

**Department of the Army**  
**Corps of Engineers**  
**Omaha District**  
**Omaha, Nebraska**

**July 1995**

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## **LIST OF ATTACHMENTS**

### **Attachment**

- 1 Field Instrument Manuals
- 2 Standard Operating Procedure (SOP) for Methane in Soil Gas
- 3 USACE Environmental Regulation No. 1110-1-263 (1 October 1990)

## **LIST OF ACRONYMS AND ABBREVIATIONS**

CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CASS	Contract Analytical Support Section
CLP	Contract Laboratory Program
CN	Cyanide
CRL	Central Regional Laboratory
DO	Dissolved Oxygen
DQO	Data Quality Objective
FD	Field Duplicate
FS	Feasibility Study
FSP	Field Sampling Plan
HCl	Hydrochloric Acid
HDPE	High Density Polyethylene
HNO <sub>3</sub>	Nitric Acid
LD	Laboratory Duplicate
ml	Milliliter
MRD	Missouri River Division
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NaOH	Sodium Hydroxide
NCP	National Contingency Plan
Pest	Chlorinated Pesticides
RB	Rinsate Blank
RD/RA	Remedial Design/Remedial Action
RI	Remedial Investigation
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RAS	Routine Analytical Services
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SOS	Scope of Services
SOW	Statement of Work
SVOC	Semivolatile Organic Compounds
TAL	Target Analyte List
TB	Trip Blank
TCL	Target Compound List
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile Organic Compounds
VTSR	Validated Time of Sample Receipt

### **3.0 PROJECT DESCRIPTION**

This Quality Assurance Project Plan (QAPP) is an addendum to the Final Quality Assurance Project Plan, Himco Dump, Remedial Investigation/Feasibility Study (RI/FS), Elkhart, Indiana, Volume 3 (Donohue, June 1990). The purpose of this QAPP Addendum is to address the data quality for the field activities during the Remedial Design/Remedial Action (RD/RA) project phases as required in the Scope of Services (SOS) issued by Region V of the United States Environmental Protection Agency (USEPA).

The objective of this RD/RA field study is to determine whether ground water quality in the vicinity of the Himco Dump Site has deteriorated since the time of the last RI sampling, which was performed in September 1991. Chemical data generated from this proposed study will be used in conjunction with information from the previous RI site investigations (Donohue, 1992) to fully characterize groundwater conditions.

The soil gas survey portion of this RD/RA field study is being conducted to quantify methane gas generation rates within and along the boundaries of the dump. The data will be used to give an estimate of the annualized methane generation rate for the entire landfill. This information will be used to support the design of a landfill gas collection system.

Activities for this project will be conducted in accordance with provisions of the Comprehensive Environmental Response, Compensation, and Liability Act/Superfund Amendments and Reauthorization Act of 1986 (CERCLA/SARA), and in accordance with appropriate requirements of the National Contingency Plan (NCP).

This QAPP Addendum addresses only those new activities to be conducted during the RD/RA. The Contract Laboratory Program (CLP) format regarding procedures and policies pertaining to the chemical data generated during the RD/RA will be followed.

#### **3.1 SITE BACKGROUND/SITE HISTORY**

The site background/site history is described in the Final Quality Assurance Project Plan, Himco Dump, Remedial Investigation/Feasibility Study (RI/FS), Elkhart, Indiana, Volume 3 (Donohue, June 1990).

#### **3.2 TARGET COMPOUNDS**

Target compounds for analysis are those listed in the CLP Target Compound List (TCL) for organics and Target Analyte List (TAL) for metals and cyanide. Specific sample analyses are presented in Section 6.0 and Table 6-1 of this QAPP Addendum. The major objective of this RD/RA field study is to determine whether ground water quality in the vicinity of the Himco Site has deteriorated since the time of the last RI sampling.

### **3.3 SAMPLING NETWORK AND RATIONALE**

#### **3.3.1 Groundwater**

Monitoring wells proposed for sampling are shown in Figure 3-1. Eleven new wells will be installed to complement existing wells. The resulting network shall comprise the completed monitoring system as specified in the Record of Decision (ROD) (EPA, 1993). Sampling locations were selected to be proximal to the expected extent of the toe of the landfill slope.

#### **3.3.2 Soil Gas**

A 200-foot by 200-foot grid was created to provide complete sampling coverage across, and just beyond, the waste area boundaries. See Figure 3-2 for proposed locations.

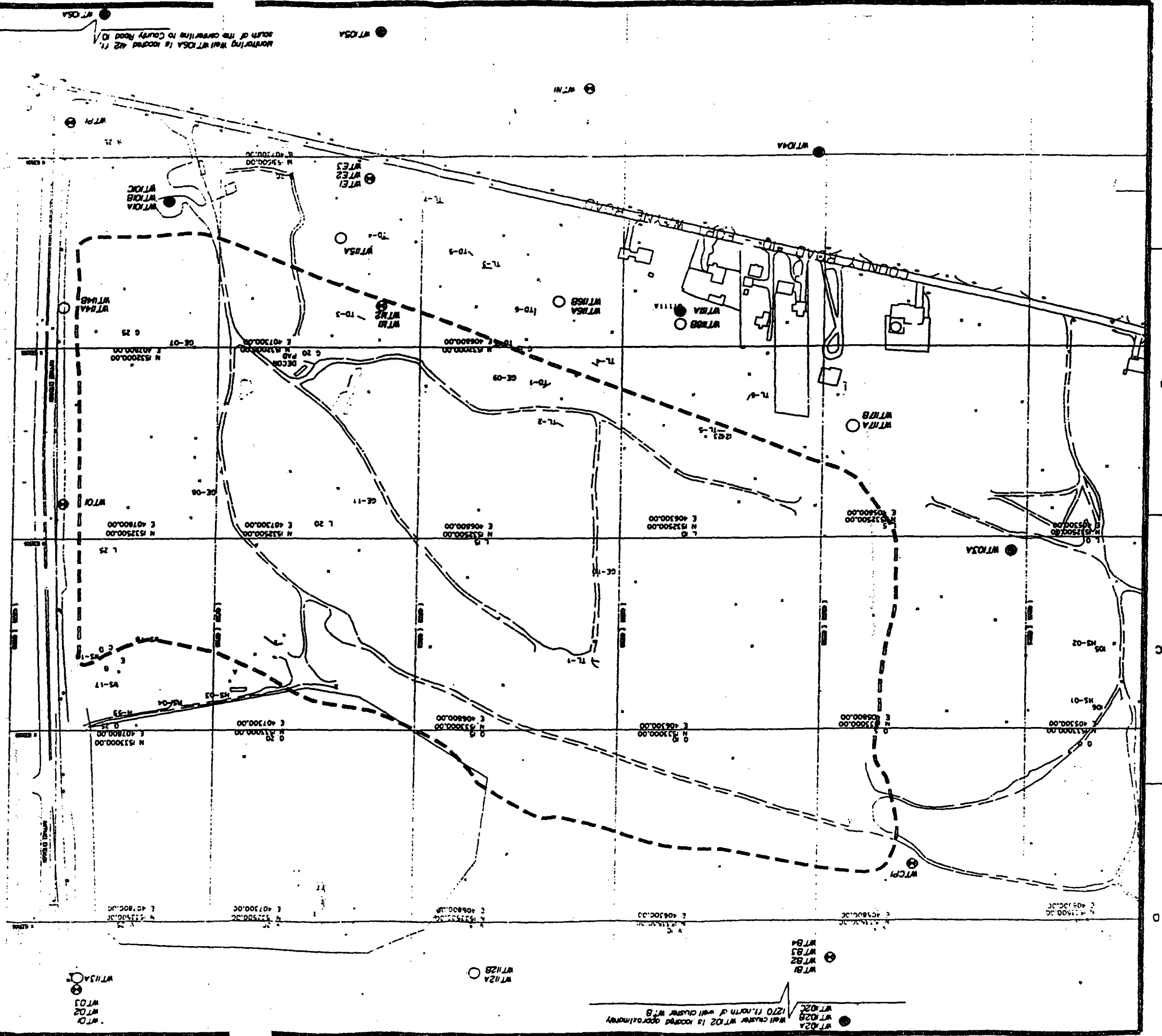
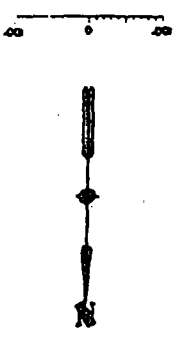
### **3.4 PROJECT SCHEDULE**

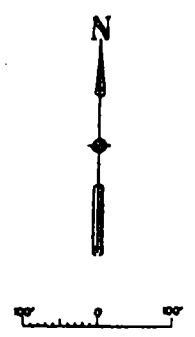
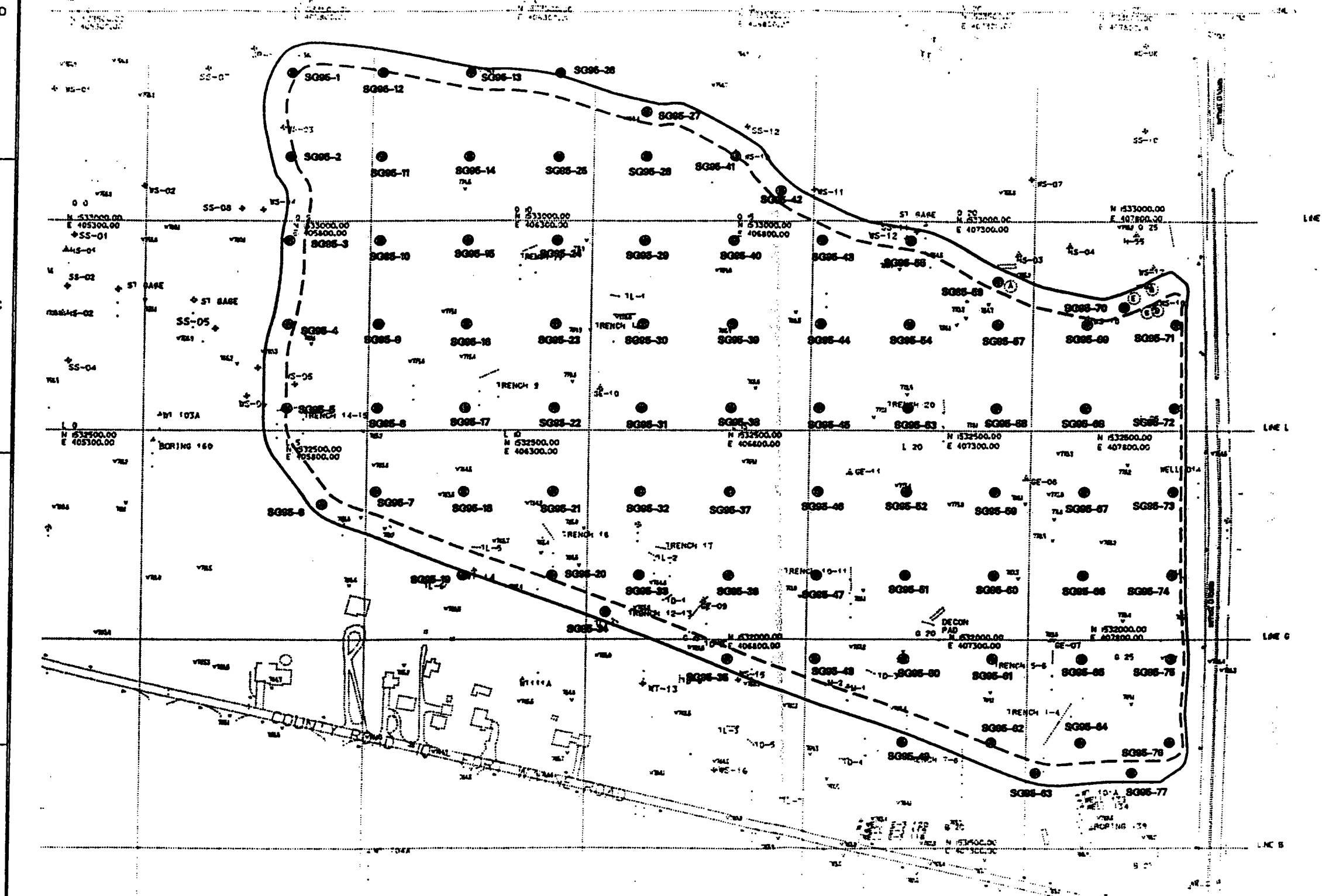
Project schedule is presented in Section 7.0 and Table 2 of Himco Dump Superfund Site, Elkhart, Indiana, Workplan for Predesign Activities (USACE, July 1995).

DESIGNED BY: DRAWN BY: CHECKED BY: APPROVED BY:	
PROJECT: LOCATION: DATE:	
SHEET: OF:	
SCALE:	
NORTH:	
TITLE:	

SS - THINK VALUE ENGINEERING - SS

- LEGEND**
- WT10A ○ Proposed Working Well
  - WT01 ⊕ Existing USGS Working Well
  - WT02 ● Existing RI Working Well
  - Appraisal Land Use Limits





- LEGEND**
- SG05-1 ● Soil Gas Survey Sampling Location
  - Approximate Landfill Limits
  - 50-Foot Beyond Landfill Limits

*Note:*  
Sampling locations are based on a 200 foot grid spacing.

SS - THINK VALUE ENGINEERING - SS			
Revisions			
Symbol	Description	Date	Approved
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA			
Designed by:	BLD/ART	INDIANA	
Drawn by:	X	X	
Checked by:	X	X	
Reviewed by:	X	X	
Submitted by:	X	X	
Chief:	X	X	
Title: <b>HIMCO DUMP SUPERFUND SITE PROPOSED SOIL GAS SAMPLING LOCATIONS</b> Figure: 3-2		Date: MAY 1988 Drawing Code: X	Sheet Number: X

## **4.0 PROJECT ORGANIZATION AND RESPONSIBILITIES**

Project organization and lines of authority are presented in Figure 4-1. Individual responsibilities are presented in the following section.

### **4.1 RESPONSIBILITIES**

#### **4.1.1 U.S. EPA Remedial Project Manager**

The U.S. EPA Region V Remedial Project Manager (RPM) is William Turpin Ballard. The RPM has the overall responsibility for the RD/RA.

#### **4.1.2 U.S. EPA Regional Quality Assurance Manager**

The U.S. EPA Regional Quality Assurance Manager (RQAM) is Willie H. Harris. The RQAM has the responsibility for review and approval of the QAPP Addendum.

#### **4.1.3 USACE Project Manager**

The USACE Project Manager (PM) is Greg Herring. The PM is responsible for implementing the project, and has the authority to commit the resources necessary to meet project objectives and requirements. The PM's primary function is to ensure that technical, financial, and scheduling objectives are achieved successfully, and will serve as the major point of contact for matters concerning the project.

#### **4.1.4 USACE Technical Manager**

The USACE Technical Manager (TM) is Steve Peterson. The TM is responsible for technical quality control and project oversight.

#### **4.1.5 USACE Project Geologist**

The USACE Project Geologist is Rick Grabowski. Responsibilities of the Project Geologist are provided in Section 3.0 of the Field Sampling Plan (FSP) Addendum.

#### **4.1.6 Project Chemist (Rust E&I)**

The Project Chemist is Greg Ruechel. Responsibilities of the Project Chemist are provided in Section 3.0 of the FSP Addendum.

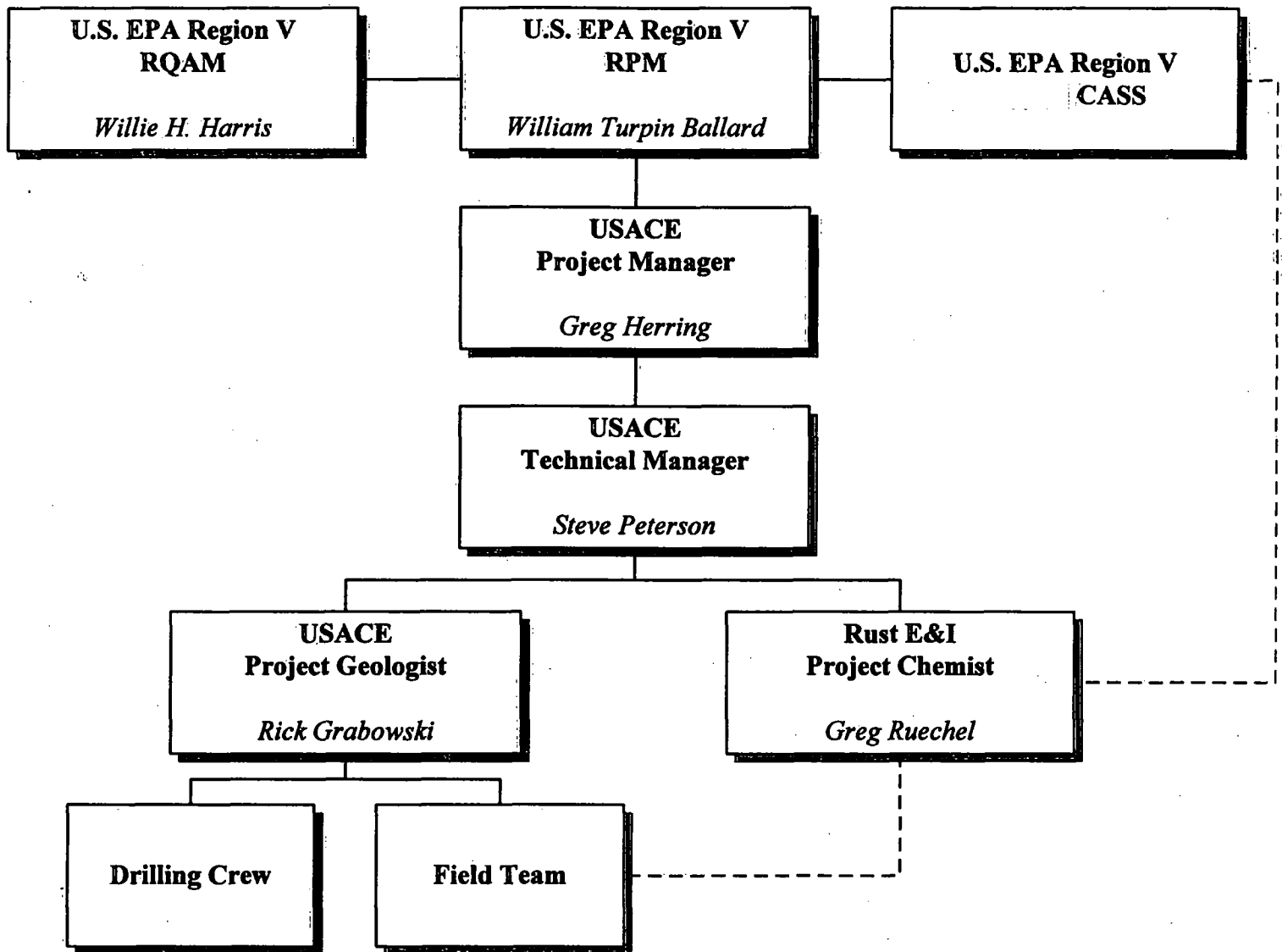
#### **4.1.7 Field Team**

Field team organization and responsibilities are provided in Section 3.0 of the FSP Addendum.



**FIGURE 4-1**

**PROJECT ORGANIZATION  
HIMCO DUMP SUPERFUND SITE**



#### 4.1.8 Sample Coordination

The Lead Field Geologist, Michelle Benak, will notify the Project Chemist when samples are <sup>to be</sup> ~~being~~ collected and shipped to the CLP laboratory for analysis. The Project Chemist will then notify the Sample Management Office (SMO) and the Region V Contract Analytical Support Section (CASS) for scheduling of CLP analyses.

Contract Laboratory Analytical Services Support (CLASS)

#### 4.1.9 Data Validation

Data validation will be performed by the Region V CASS.

#### 4.1.10 External Performance and Systems Audits

The external performance and system audits of field and laboratory activities may be conducted by the U.S. EPA Region V CASS.

## 5.0 QUALITY ASSURANCE OBJECTIVES

The specific objectives for analytical precision, accuracy and completeness are described in the Final Quality Assurance Project Plan, Himco Dump, Remedial Investigation/Feasibility Study (RI/FS), Elkhart, Indiana, Volume 3 (Donohue, June 1990).

### 5.1 FIELD QUALITY CONTROL EFFORT

To assess whether the overall quality assurance objectives have been met, analyses of specific field quality control samples will be required. These quality control samples include Rinsate blanks and field duplicates. The preparation of each of these types of samples is described in Section 6.0. The frequency with which they will be collected is given in Table 6-1.

### 5.2 QUALITY ASSURANCE OBJECTIVES FOR FIELD MEASUREMENTS

#### 5.2.1 Groundwater

Field measurements will be taken for pH, temperature, specific conductivity, dissolved oxygen, and turbidity. Accuracy of field measurements will be addressed through pre-measurement calibrations. Instruments will be calibrated according to the manufacturer's instructions contained in the instrument manuals. The instrument manuals are provided in Attachment 1 of this QAPP Addendum.

Precision of field measurements will be addressed by taking a duplicate set of measurements, after the parameters have stabilized, at a frequency of one for every ten or fewer investigative samples. For pH, duplicate measurements shall agree within  $\pm 0.1$  standard units. For temperature, duplicate measurements shall agree within  $\pm 0.5^{\circ}\text{C}$ . For dissolved oxygen, duplicate measurements shall agree within  $\pm 0.1$  mg/l. For specific conductivity and turbidity, duplicate measurements shall agree within  $\pm 10$  percent.

Sensitivity of field measurements is determined by the smallest unit of measurement the instrument is capable of providing. For pH, the instrument used shall be capable of providing measurements of 0.01 standard units. For temperature, the thermometer shall be capable of providing measurements of  $1.0^{\circ}\text{C}$ . For dissolved oxygen, the meter shall be capable of providing measurements of 0.1 mg/l. For specific conductance, the instrument shall be capable of providing measurements of 10 umhos/cm. For turbidity, the instrument shall be capable of providing measurements of 0.1 NTU.

#### 5.2.2 Soil Gas

Field measurements of methane in soil gas will be taken. A Standard Operating Procedure (SOP) for taking the methane measurement is provided in Attachment 2 of this QAPP Addendum. Accuracy will be addressed by calibrating the instrument according to the manufacturer's instructions

contained in the instrument manual. The instrument manual is provided in Attachment 1 of this QAPP Addendum.

Since measurements of methane will be taken by venting the gas that has collected in a collection pipe directly into the instrument, duplicate measurements of methane cannot be taken.

Sensitivity of the instrument is described in the instrument manual provided in Attachment 1 of this QAPP Addendum.

## 6.0 SAMPLING PROCEDURES

Eleven groundwater monitoring wells are proposed for installation at various locations and depths around the Himco Site. These eleven wells, as well as eight existing groundwater monitoring wells have been selected for chemical analysis based on the 1984 and 1991 RI historical data and on data needs for the remedial alternative selection process. Complete descriptions of sampling activities including sampling locations, sample numbers, and rationale are presented in the Field Sampling Plan (FSP) Addendum II for Remedial Design/Remedial Action Field Activities at the Himco Dump Superfund Site, Elkhart, Indiana.

Groundwater samples obtained from these new and existing wells and two water source blanks will be analyzed for:

- CLP TCL Volatile Organic Compounds (VOC).
- CLP TCL Semivolatile Organic Compounds (SVOC).
- CLP TCL Chlorinated Pesticides and Aroclors.
- CLP TAL Metals/Cyanide

However, the following changes have occurred in the TCL subsequent to the approval of Final Quality Assurance Project Plan, Himco Dump, Remedial Investigation/Feasibility Study (RI/FS), Elkhart, Indiana, Volume 3 (Donohue, June 1990):

- Vinyl acetate was removed from the TCL VOC analysis.
- Benzyl alcohol, bis (2-chloroisopropyl) ether, and benzoic acid were removed from the TCL SVOC analysis.
- 2,2'-oxybis (1-chloropropane) and carbazole were added to the TCL SVOC analysis. Both compounds have Contract Required Detection Limits (CRDL) in water of 10 ug/l.
- Endrin aldehyde was added to the TCL chlorinated pesticide and aroclor analysis. The CRDL for endrin aldehyde in water is 0.10 ug/l.

The sample and analysis summary is presented in Table 6-1.

Sample containers, preservatives, volumes, and required holding times are summarized in Table 6-2. Contract required holding times listed are based on the Validated Time of Sample Receipt (VTSR).

TABLE 6-1

**SAMPLING AND ANALYSIS SUMMARY  
REMEDIAL DESIGN/REMEDIAL ACTION FIELD ACTIVITIES  
HIMCO DUMP SUPERFUND SITE  
ELKHART, INDIANA**

SAMPLE MATRIX	FIELD PARAMETERS	DQO LEVEL	LAB PARAMETERS	DQO LEVEL	LAB	# FIELD SAMPLES	FIELD QC			TOTAL TO LAB	LAB QC	USACE QA		
							TB <sup>(1)</sup>	RB	FD <sup>(6)</sup>		LD/MS/MSD <sup>(2)</sup>	TB	RB	FD
Existing USGS Wells (Groundwater)	Water Level	I	TCL VOC	IV	CLP	8	2	1	1	12	1	1	-	1
	pH	I	TCL SVOC	IV	CLP	8	-	1	1	10	1	-	-	1
	Conductivity	I	TCL Pest/Aroclor <sup>(3)</sup>	IV	CLP	8	-	1	1	10	1	-	-	1
	DO	I	TAL Metals/CN	IV	CLP	8	-	1	1	10	1	-	-	1
	Temperature	I	(Total) <sup>(4)</sup>											
	Turbidity	I												
New Installed Wells (Groundwater)	Water Level	I	TCL VOC	IV	CLP	11	3	1	1	16	1	1	-	1
	pH	I	TCL SVOC	IV	CLP	11	-	1	1	13	1	-	-	1
	Conductivity	I	TCL Pest/Aroclor <sup>(3)</sup>	IV	CLP	11	-	1	1	13	1	-	-	1
	DO	I	TAL Metals/CN	IV	CLP	11	-	1	1	13	1	-	-	1
	Temperature	I	(Total) <sup>(4)</sup>											
	Turbidity	I												
Water Source Blanks	pH <sup>(5)</sup>	I	TCL VOC	IV	CLP	2	1	-	-	3	-	-	-	-
	Conductivity	I	TCL SVOC	IV	CLP	2	-	-	-	2	-	-	-	-
	Temperature	I	TCL Pest/Aroclor <sup>(3)</sup>	IV	CLP	2	-	-	-	2	-	-	-	-
			TAL Metals/CN	IV	CLP	2	-	-	-	2	-	-	-	-
			(Total) <sup>(4)</sup>											
Soil Gas	Methane	I	N/A	N/A	N/A	462 <sup>(7)</sup>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NOTES: <sup>(1)</sup> Trip blanks will be shipped at frequency of one per cooler of aqueous samples for VOC analysis. This number is an estimate based on the number of coolers anticipated to be shipped. <sup>(2)</sup> MS/MSD samples required for organic analysis. Groundwater samples shall be collected, with extra sample volume at a frequency of one per 20 or fewer investigative samples. Triple the normal volume will be collected for VOCs and double the normal volume will be collected for SVOCs and Pest/Aroclor. <sup>(3)</sup> The terms Aroclor and Polychlorinated Biphenyl (PCB) can be interchangeable. <sup>(4)</sup> Total metals are defined as digestion and analysis of TAL metals on an unfiltered sample. <sup>(5)</sup> Field Parameters will only be collected at the water supply point. <sup>(6)</sup> One field duplicate to be collected from the shallow aquifer and one field duplicate to be collected from the intermediate aquifer. <sup>(7)</sup> Number of field samples for methane soil gas, 462 samples, represents 6 measurements at each of the 77 sample points.														
LEGEND:														
DQO	Data Quality Objective		VOC	Volatile Organic Compounds		RB	Rinse Blank							
CLP	Contract Laboratory Program		SVOC	Semivolatile Organic Compounds		FD	Field Duplicate							
QC	Quality Control		Pest	Chlorinated Pesticides		LD	Laboratory Duplicate							
TCL	Target Compound List		CN	Cyanide		MS/MSD	Matrix Spike/Matrix Spike Duplicate							
TAL	Target Analyte List		USGS	United States Geological Survey		TB	Trip Blank							
DO	Dissolved Oxygen													

TABLE 6-2

**SAMPLE CONTAINERS, PRESERVATIVES, VOLUMES, AND HOLDING TIMES  
REMEDIAL DESIGN/REMEDIAL ACTION FIELD ACTIVITIES  
HIMCO DUMP SUPERFUND SITE  
ELKHART, INDIANA**

Sample Matrix	Analyses	Container	Preservative	Maximum Holding Time	Volume
Groundwater	TCL VOC*	(2) 40-ml glass vials	4°C; 1-2 drops HCl	10 days	Full; No Headspace with Teflon septato pH <2;
	TCL SVOC*	(2) 1-liter amber glass bottles	4°C	5 days to extraction; 40 days to analyze	Fill to shoulder
	TCL Pest/Aroclor*	(2) 1-liter amber glass bottles	4°C	5 days to extraction; 40 days to analyze	Fill to shoulder
	TAL Metals (Total)	1-liter HDPE bottle	5-ml (1:1)HNO <sub>3</sub> , per liter to pH<2	Metals: 180 days Hg: 26 days	Fill to shoulder
	Cyanide	1-liter HDPE bottle	4°C; 5-ml 6N NaOH per liter to pH >12	12 days	Fill to shoulder

NOTES:

\* Triple volume must be collected for MS/MSD analyses for volatiles; double volume must be collected for SVOC and PCB/Pest.

TCL	Target Compound List	Pest	Chlorinated Pesticide	HCl	Hydrochloric Acid
TAL	Target Analyte List	HDPE	High Density Polyethylene	HNO <sub>3</sub>	Nitric Acid
VOC	Volatile Organic Compound	Hg	Mercury	NaOH	Sodium Hydroxide
SVOC	Semivolatile Organic Compound	N	Normality (Normal)	ml	milliliter

## **7.0 SAMPLE CUSTODY PROCEDURES**

### **7.1 CUSTODY PROCEDURES FOR CLP SAMPLES**

Custody procedures for samples submitted to the CLP laboratories are described in the Final Quality Assurance Project Plan, Himco Dump, Remedial Investigation/Feasibility Study (RI/FS), Elkhart, Indiana, Volume 3 (Donohue, June 1990).

### **7.2 CUSTODY PROCEDURES FOR QA SAMPLES**

Custody procedures for samples submitted to the USACE Missouri River Division QA Laboratory (QA samples) are described in Appendix F of USACE Environmental Regulation No. 1110-1-263 (1 October 1990). Environmental Regulation No. 1110-1-263 is provided in Attachment 3 of this QAPP Addendum.

### **7.3 FINAL EVIDENCE FILES CUSTODY PROCEDURES**

The USACE maintains RD/RA files along with all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, bottle testing results, and U.S. EPA Region V CASS reviewed data in a secured, limited-access area under custody of the USACE Project Manager.

Final evidence files from the CLP are maintained by the U.S. EPA Region V Records Center.



## **8.0 CALIBRATION PROCEDURES**

Laboratory and field calibration procedures are presented in the Final Quality Assurance Project Plan, Himco Dump, Remedial Investigation/Feasibility Study (RI/FS), Elkhart, Indiana, Volume 3 (Donohue, June 1990).

Calibration procedures for the groundwater and soil gas field measurement parameters taken during the predesign investigation are those contained in the manufacturer's instrument manuals. The instrument manuals are provided in Attachment 1 of this QAPP Addendum.

## **9.0 ANALYTICAL PROCEDURES**

### **9.1 LABORATORY PROCEDURES**

Routine Analytical Services (RAS) laboratory procedures will be used for the Himco Dump Site RD/RA. The current EPA CLP Statement of Work (SOW) for Organics, OLM03.1, including revisions, and the SOW for Inorganic Analysis, ILM03.0, specify the analytical procedures to be used. Included in the SOW are sample custody procedures, instrument calibration procedures, and frequency of calibration. Table 9-1 summarizes the analytical methods to be used.

### **9.2 FIELD SCREENING ANALYTICAL PROCEDURES**

Field measurements of pH, conductivity, temperature, dissolved oxygen (DO), and turbidity will be performed at each well location. Field measurements of pH, conductivity, and temperature will be taken at the water supply points. Field measurements will be taken according to the manufacturer's instructions contained in the instrument manuals provided in Attachment 1 of this QAPP Addendum.

Field measurements of methane in soil gas will be taken six times over 24 hours at each of 77 sample points. The SOP for methane in soil gas is included as Attachment 2 of this QAPP Addendum.

**TABLE 9-1**

**ANALYTICAL METHODS  
REMEDIAL DESIGN/REMEDIAL ACTION FIELD ACTIVITIES  
HIMCO DUMP SUPERFUND SITE  
ELKHART, INDIANA**

Analyses	Required Method
TCL Volatile Organic Compounds	CLP SOW OLM03.1
TCL Semivolatile Organic Compounds	CLP SOW OLM03.1
TCL Pesticides/Aroclors	CLP SOW OLM03.1
TAL Metals/Cyanide (Total)	CLP SOW ILM03.0
<b>LEGEND:</b>  TCL      Target Compound List TAL      Target Analyte List CLP      Contract Laboratory Program SOW      Statement of Work	

## **10.0 INTERNAL QUALITY CONTROL CHECKS**

Internal quality control checks are outlined in the Final Quality Assurance Project Plan, Himco Dump, Remedial Investigation/Feasibility Study (RI/FS), Elkhart, Indiana, Volume 3 (Donohue, June 1990).

## **11.0 DATA REDUCTION, VALIDATION, AND REPORTING**

Date reduction, validation, and reporting is described in the Final Quality Assurance Project Plan, Himco Dump, Remedial Investigation/Feasibility Study (RI/FS), Elkhart, Indiana, Volume 3 (Donohue, June 1990) with the following exception:

- Data packages will be submitted to, and data validation will be performed by, U.S. EPA Region V CASS.

## **12.0 PERFORMANCE AND SYSTEM AUDITS**

Performance and system audits are described in the Final Quality Assurance Project Plan, Himco Dump, Remedial Investigation/Feasibility Study (RI/FS), Elkhart, Indiana, Volume 3 (Donohue, June 1990) with the following exception:

- The external performance and system audits of field and laboratory activities may be conducted by the U.S. EPA Region V CASS.

### **13.0 PREVENTIVE MAINTENANCE**

Preventive maintenance is described in the Final Quality Assurance Project Plan, Himco Dump, Remedial Investigation/Feasibility Study (RI/FS), Elkhart, Indiana, Volume 3 (Donohue, June 1990).

#### **14.0 SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS**

Specific routine procedures to assess data precision, accuracy, and completeness is presented in the Final Quality Assurance Project Plan, Himco Dump, Remedial Investigation/Feasibility Study (RI/FS), Elkhart, Indiana, Volume 3 (Donohue, June 1990) with the following exception:

- The RAS laboratory data will be reviewed by the U.S. EPA Region V CASS.



## **15.0 CORRECTIVE ACTION**

Corrective action procedures are described in the Final Quality Assurance Project Plan, Himco Dump, Remedial Investigation/Feasibility Study (RI/FS), Elkhart, Indiana, Volume 3 (Donohue, June 1990) with the following exception:

- The U.S. EPA Region V CASS may request corrective action by the CLP laboratory, not the Region V LSSS.

## **16.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT**

Quality assurance reports to management are presents in the Final Quality Assurance Project Plan, Himco Dump, Remedial Investigation/Feasibility Study (RI/FS), Elkhart, Indiana, Volume 3 (Donohue, June 1990) with the following exception:

- The Donohue Technical Advisory Committee (TAC) and Donohue Technical Services/Quality Assurance Manager (TSQAM) are not applicable to the RD/RA predesign activities.

**ATTACHMENT 1**  
**FIELD INSTRUMENT MANUALS**

**OPERATION AND CALIBRATION INSTRUCTIONS  
FROM  
INSTRUCTION MANUAL FOR  
TRACE GAS ANALYZER  
HNU MODEL PI 101**

## SECTION 2

### OPERATION

#### 2.1 INTRODUCTION/UNPACKING

Unpack the instrument carefully. The carton will contain the housing, straps, battery charger, additional probes, regulator and cylinder if ordered, spare parts, supplies and a manual. Be sure all items are removed before discarding the carton.

Attached to the instrument is a warranty card which should be filled out completely and returned to HNU Systems.

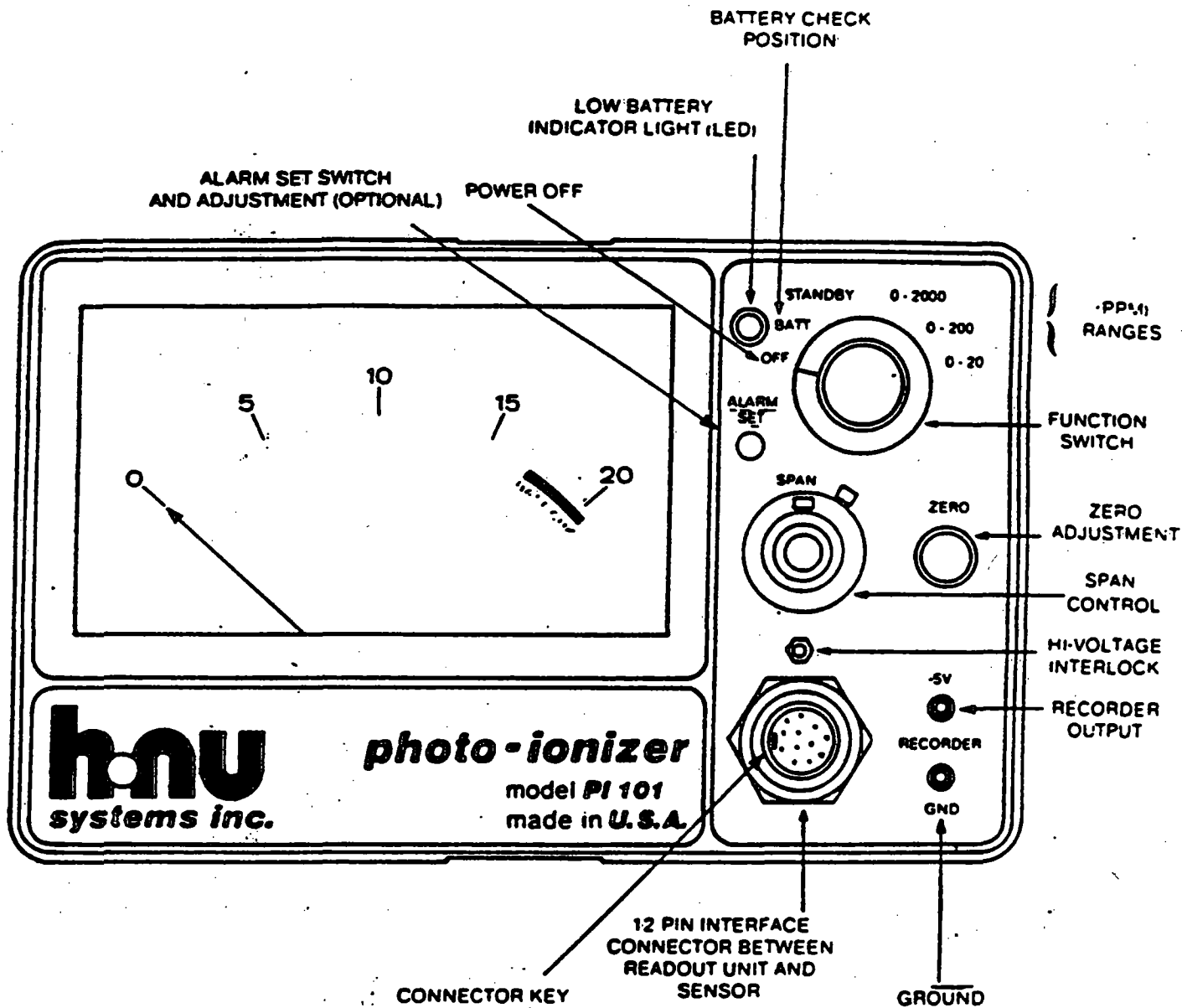
#### 2.2 CONTROLS AND INDICATORS

The controls and indicators are located on the front panel of the readout assembly (see Figure 2-1) and are listed and described in Tables 2-1 and 2-2.

#### 2.3 OPERATING PROCEDURES

The following procedures are to be used in operating the analyzer:

- a. Unclamp the cover from the main readout assembly.
- b. Remove the inner lid from the cover by pulling out the two fasteners.
- c. Remove the probe, handle and cable from the cover. Attach the handle to the front part of the probe.
- d. Connect the probe cable plug to the 12 pin keyed socket on the readout assembly panel. Carefully match the alignment slot in the plug to the key in the connector. Screw down the probe connector until a distinct snap and lock is felt.
- e. Screw the probe extension into the probe end cap. The probe may be used without the extension if desired.
- f. Set the SPAN control for the probe being used (10.2, 9.5, or 11.7 eV) as specified by the initial factory calibration or by subsequent calibrations.



**FIGURE 2-1**  
**CONTROLS AND INDICATORS**

TABLE 2-1

## CONTROLS

Name	Position	Function
-----		
Function Switch	---	Controls the operation of the analyzer
	OFF	All operations OFF
	BATT (battery check)	Checks the condition of the battery. If the meter needle is in the green arc, the battery is charged. If not the battery should be recharged. Charging can be done in any position, best in OFF; see directions on charger.
	STANDBY	All electronics ON, ultraviolet (UV) light source OFF. This position conserves power and extends battery life. This position is used to set the analyzer zero position. (i.e. no UV light, no signal)
	0-2000	Sets range of meter at 0-2000 ppm.
	0-200	Sets range of meter at 0-200 ppm.
ZERO	0-20	Sets range of meter at 0-20 ppm.
	---	With the function switch in STANDBY position, this potentiometer is used to adjust the reading to zero.

NOTE: See Figure 2-1 for locations.

TABLE 2-1 cont.

SPAN	---	This vernier potentiometer is used to set the gain of the amplifier to give direct readings of the trace gas concentrations in ppm. The whole number of the setting appears in the window of the control, decimal appears on the dial. A lock secures it at a specific setting.
HI-VOLTAGE	---	This is a normally open microswitch.
	Open	Switch is open when cable not connected, disconnecting high voltage for the UV lamp from the 12 pin connector as a safety precaution.
	Closed	Switch is automatically closed when the cable is attached. This switch may also be closed manually during maintenance checks of the readout assembly without the probe cable attached.
ALARM SET (optional)	---	Potentiometer with screw-driver adjustment. Turns the audible alarm ON or OFF and sets the ppm level at which the alarm sounds. If alarm is low limit, it sounds when measured ppm falls below this value. If alarm is high limit it sounds when measured ppm exceeds this value.

NOTE: See Figure 2-1 for locations.



**TABLE 2-2**  
**INDICATORS AND DISPLAYS**

<b>Name</b>	<b>Function</b>
<b>Low Battery Indicator Light</b> (red light) (see NOTE)	<p>Illuminates when battery is discharged, indicates need for recharge.</p> <p>Do not use unit when this light is ON.</p> <p>Readings may be taken while battery is being recharged.</p>
<b>Meter (see NOTE)</b>	Indicates concentration of measured gas.
<b>Recorder (optional)</b> (see Figures 2-1 And 8-3)	<p>Provides a record of readings while analyzer operates unattended.</p> <p>Recorder inputs 0 to -5 V DC.</p>

**NOTE:** See Figure 2-1 for locations.

## SECTION 2.3. OPERATING PROCEDURES cont.

- g. Turn the function switch to the BATT (battery check) position. The needle on the meter will go to the green zone if the battery is fully charged. If the needle is below the green arc or if the Low Battery Indicator comes on, the battery must be recharged before the analyzer is used.
  - h. Set SPAN pot to the desired value based on the gas to be used.
  - i. Turn the function switch to the STANDBY position. Turn the zero adjustment until the meter needle is at zero.
  - j. Calibrate the instrument daily as described in Section 3. Calibration on the selected operating range is desirable.
  - k. If equipped with optional alarm, set or check the alarm setting at the level desired. Turn the function switch to the desired range, turn the zero adjustment control so the meter needle moves upscale thru the desired value. This simulates real conditions. Observe the reading when the alarm sounds. Adjust the ALARM SET, if required, with a screw driver. Turn the function switch to the STANDBY position and reset the zero position (para. h. above). If the range is to be changed, the alarm must be reset on that range.
  - l. To operate with optional recorder, add the recorder bracket (see Figure 8-3). Remove the plug in the analyzer case and insert power cord into the recorder. Then connect the signal leads to the appropriate jacks in the control module. The recorder is now operational.
- NOTE: Ranges must be marked on the chart as the recorder prints the meter display as % of Full Scale.
- m. Turn the function switch to the appropriate operating position. Start with the 0-2000 position and then switch to the more sensitive ranges. The UV light source should be on, confirmed by briefly looking into the probe to observe a purple glow from the lamp.

-----  
WARNING  
-----

Do not look at the light source closer than 6 inches with unprotected eyes. Observe only if necessary, then only briefly. Continued exposure to ultraviolet energy generated by the light source can be harmful to eyesight.

**SECTION 2.3. OPERATING PROCEDURES cont.**

- n. The analyzer is now operational.
- o. Hold the probe so that the extension is at the point where the measurement is to be made. The instrument measures the concentration by drawing the gas in at the end of the extension, through the ionization chamber, and out the handle end of the probe.

-----  
**WARNING**  
-----

The instrument measures gases in the vicinity of the operator and a high reading when measuring toxic or explosive gases should be cause for action for operator safety.

- p. Take the reading or readings as desired taking into account that air currents or drafts in the vicinity of the probe tip may cause fluctuations in readings. Change the ranges as required.
- q. Check battery condition as required. If the Low Battery Indicator comes on, turn analyzer off and recharge.

-----  
**CAUTION**  
-----

Use only in an emergency with a low battery when on battery charge.

## SECTION 2.3, OPERATING PROCEDURES cont.

- r. After completion of use, check battery condition as described in para. g.
- s. Turn function switch to OFF position.
- t. When not operating, leave analyzer in assembled condition, and connected to battery charger.
- u. When transporting, disassemble probe and extension from readout assembly and return equipment to its stored condition.
- v. In case of emergency, turn function switch to OFF position.

### 4 BATTERY CHARGE

Check the battery charge as described in paragraph 2-3 g during each period of operation, at least once daily. If the battery is low as indicated by the meter reading or the warning indicator, it is necessary to recharge the battery.

To charge the battery, first insert the mini phone plug of the charger into the jack, J6, on the side of the bezel adjacent to the meter. Then insert the charger plug into a 120 or 230 V AC single phase, 50-60 cycle outlet. To ensure that the charger is functioning, turn the function switch, S1, to the battery check (BATT) position. The meter should deflect full scale if the charger is working and connections properly made. For normal battery charging, leave the function switch in the OFF position.

The analyzer can be operated, however, while recharging by turning the function switch to the desired position. Such usage will extend the time required to completely recharge the battery. The battery charger is not Div. II approved.

NOTE: On all Sira approved PI 101s it is necessary to connect the probe assembly before turning on the instrument and re-charging. Without following this procedure the instrument will not show battery check.

SECTION 3  
CALIBRATION

**3.1 INTRODUCTION**

The PI 101 Analyzer is designed for trace gas analysis in ambient air and is calibrated at HNU with certified standards of benzene, vinyl chloride and isobutylene. Other optional calibrations are available (e.g., ammonia, ethylene oxide, H<sub>2</sub>S, etc.). Calibration data is given in the data sheet. If a special calibration has been done, the data is given in the Application Data Sheet, which notes the sample source, type of calibration (see Section 8, Appendix), and other pertinent information.

Good instrumentation practice calls for calibration on the species to be measured in the concentration range to be used. This procedure assures the operator that the analyzer is operating properly and will generate reliable data.

Some general points to consider when calibrating the PI 101 are that the analyzer is designed for operation at ambient conditions and therefore the gas standards used for calibration should be delivered to the analyzer at ambient temperatures and pressure and at the proper flow rates.

-----  
**WARNING:**  
-----

The PI 101 is a non-destructive analyzer; calibrations using toxic or hazardous gases must be done in a hood.

The frequency of calibration should be dictated by the usage of the analyzer and the toxicity of the species measured. If the analyzer has been serviced or repaired, calibration should be done to verify operation and performance. It is recommended that calibration be checked frequently at first (daily or every other day) and then regularly based on the confidence level developed.

The normal meter scaleplate is 0 to 20. If the scaleplate is different, refer to the Application Data Sheet. If there are questions, consult the HNU representative before proceeding with calibration check.

An accurate and reliable method of calibration check is to use an analyzed gas cylinder in a test setup as shown in Figure 3-1 and described below. Additional material on calibration is given in Section 8, Appendix.

**ANALYZED GAS CYLINDER**

- a. **Concentration** - The calibration gas cylinder is to contain the species of interest made up in an air matrix at or near the concentration to be analyzed. If the component is unstable in air, another matrix is to be used. The final calibration mixture should be similar to the sample the PI 101 will analyze. If the expected concentration is not known then a concentration should be chosen that will cause a scale displacement of 50 to 80% on the X10 range. Calibration on X10 range will provide accurate values on the X1 range as well.

For use on the 0-2000 range, a two-standard calibration is preferred: one at 70 to 85% of the linear range and the other at 25 to 35% of the linear range. With the linear range of approximately 600 ppm for most compounds these points would lie between 420 to 510 ppm and 150 to 210 ppm, respectively.

- b. Stability - The calibration gas must be stable within the cylinder during the period of use. If the calibration is required in the field, then use of a small cylinder is recommended. In addition, the choice of cylinder material in contact with the gas must be considered (steel, aluminum or teflon). If there are any questions, the operator should request stability and usage information from the gas supplier.

-----  
**WARNING**  
-----

Extreme care must be taken in the handling of gas cylinders. Contents are under high pressure. In some cases, the contents may be hazardous. Many gas suppliers will provide data sheets for the mixtures upon request.

- c. Delivery - The cylinder containing the calibration mixture must be connected to a proper regulator.

-----  
**WARNING**  
-----

Never open the valve on a gas cylinder container without a regulator attached.

Leak test all tank/regulator connections as well as the main cylinder valve to prevent toxic or hazardous materials from leaking into the work area. Care must be taken that the materials of construction of the regulator will not interact with the calibration gas.

One method of sampling the calibration gas is illustrated in Figure 3-1. Connect the cylinder to one leg of the tee, a flow meter to the opposite leg, and the probe to the third leg. The flow meter does not require a valve. If there is a valve, it must be left wide open. The flowmeter is only to indicate excess flow. Adjust the flow from the regulator such that only a little excess flow is registered at the flowmeter.

## SECTION 3.2, ANALYZED GAS CYLINDER cont.

This insures that the PI 101 sees the calibration gas at atmospheric pressure and ambient temperature.

- d. Usage - Generally, a gas cylinder should not be used below 200-300 psi as pressure effects could cause concentration variations. The cylinder should not be used past the recommended age of the contents as indicated by the manufacturer. In case of difficulty, verify the contents and concentration of the gas cylinder.
- e. Alternate means of calibration are possible. For more information, contact the HNU Service Department.

## .3 PROBE

- a. Identify the probe by the lamp label. If a question exists, disassemble the probe and inspect the lamp. The energy of the lamp is etched into the glass envelope.
- b. Connect the probe to the readout assembly, making sure the red interlock switch is depressed by the ring on the connector.
- c. Set the SPAN pot to the proper value for the probe being calibrated. Refer to the calibration memo accompanying the probe.
- d. Check the Ionization Potential (IP) of the calibration gas to be used. The IP of the calibration gas must be at or below the IP of the lamp.
- e. Proceed with the calibration as described in Section 3.4. Check the calibration memo for specific data. If any questions develop, call the HNU representative.
- f. NOTE: The 11.7eV lamp has a special cleaning compound. Do not use water or any other cleaning compound with the 11.7 eV lamp. Do not interchange ion chambers, amplifier boards or lamps between probes. (See Section 5.2).

## 3.4 PROCEDURE

- a. Battery check - Turn the function switch to BATT. The needle should be in the green region. If not, recharge the battery.

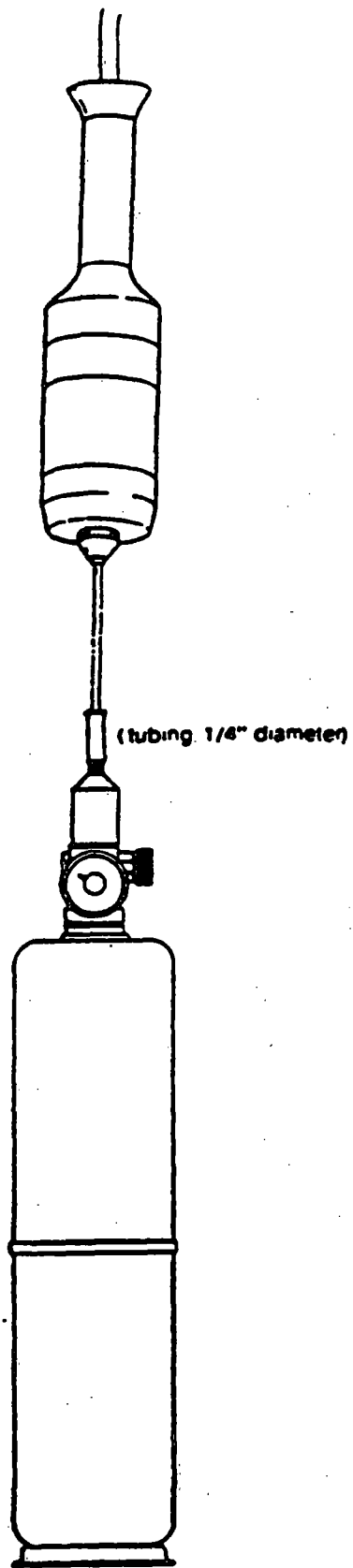
## SECTION 3.4. PROCEDURE cont.

- b. Zero set - Turn the function switch to STANDBY. In this position the lamp is OFF and no signal is generated. Set the zero point with the ZERO set control. The zero can also be set with the function switch on the X1 position and using a "Hydrocarbon-free" air. In this case "negative" readings are possible if the analyzer measures a cleaner sample when in service.
- c. 0-20 or 0-200 range - For calibrating on the 0-20 or 0-200 range only one gas standard is required. Turn the function switch to the range position and note the meter reading. Adjust the SPAN control setting as required to read the ppm concentration of the standard. Recheck the zero setting (step b.). If readjustment is needed, repeat step c. This gives a two-point calibration; zero and the gas standard point. Additional calibration points can be generated by dilution of the standard with zero air if desired (see Section 8).
- d. 0-2000 range - For calibrating on the 0-2000 range, use of two standards is recommended as cited in Section 3.2a. First calibrate with the higher standard using the SPAN control for setting. Then calibrate with the lower standard using the ZERO adjustment. Repeat these several times to ensure that a good calibration is obtained. The analyzer will be approximately linear to better than 600 ppm, (see Figure 3-2). If the analyzer is subsequently to be used on the 0-20 or 0-200 range, it must be recalibrated as described in steps b. and c. above.
- e. Lamp cleaning - If the span setting resulting from calibration is 0.0 or if calibration cannot be achieved, then the lamp must be cleaned (see Section 5.2).
- f. Lamp replacement - If the lamp output is too low or if the lamp has failed, it must be replaced (see Section 5.3).

## 5 CALIBRATION CHECKING

Rapid calibration checking in the field can be accomplished by use of a small disposable cylinder containing isobutylene. Immediately after a calibration has been completed, a reading is taken on a special isobutylene standard. This provides a reference concentration measurement for later checking in the field. This can be done at any time with a portable cylinder containing this same special standard, using this reference reading as a check, and making adjustments to the analyzer if necessary. In effect, this is an indirect method of calibration, one maintaining the calibration to give direct readings for the original gas mixture, but using the portable isobutylene cylinder. Details are given in Section 8.2 of the Appendix.





**FIGURE 3-1  
CALIBRATION TEST SET UP**

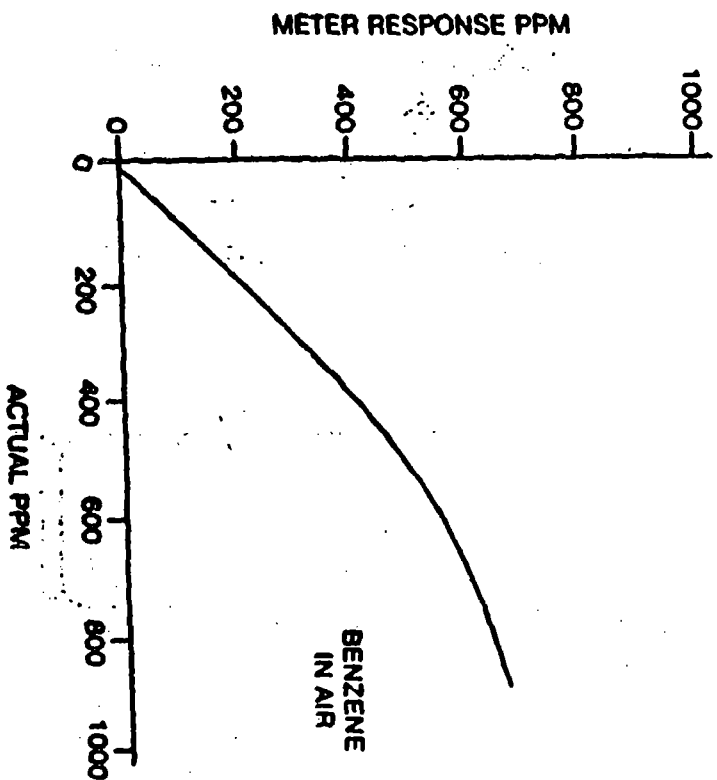
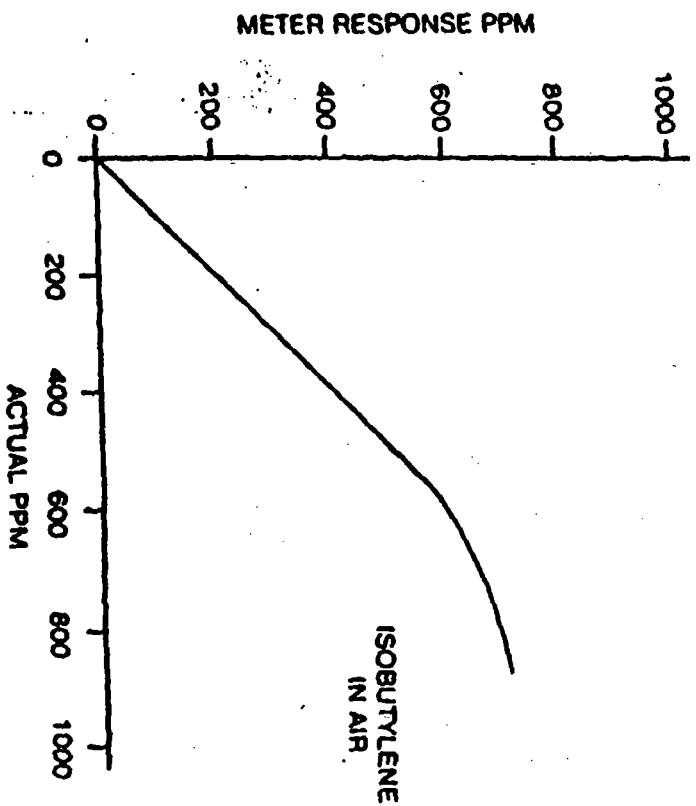


FIGURE 3-2  
TYPICAL CALIBRATION CURVES (10.2 eV)

**OPERATION AND CALIBRATION INSTRUCTIONS  
FROM  
INSTRUCTION MANUAL FOR  
TMX410 MULTI-GAS MONITOR**

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**General Information**

**Air and Gases**

Air is a mixture of gases. Clean, dry air consists of 78.08 volume percent nitrogen, 20.95 volume percent oxygen, and 0.87 volume percent other gases including argon and carbon dioxide. Life, combustion and various chemical reactions are supported by oxygen. Human beings can tolerate moderate variations in the amount of oxygen in the air. Breathing becomes labored when the air contains only 16% oxygen.

However, the U.S. Department of Labor – OSHA (General Industry Safety and Health Standards 29 CFR 1910.94 (d) (9) (vi) requires the use of air-supplied respirators to provide adequate oxygen when the concentration of oxygen is less than 19.5%. Oxygen deficiency can be the result of the displacement of oxygen by other gases, aerobic bacterial activity, combustion, and the oxidation of metal.

A mixture of air and a combustible gas or vapor (hereafter the term 'gas' shall be understood to mean combustible gases and/or vapors) will support the propagation of a flame away from a source of ignition only when the concentration of the gas, as a percent of the total volume of the mixture, is within the flammable range of that specific gas or combination of gases. The flammable range has both a lower limit and an upper limit. An air/gas mixture in which the concentration of gas is below the flammable range will be too lean to propagate combustion; conversely, when the concentration is above the flammable limit it is too rich.

*Note: Lower Flammable Limit (LFL) and Lower Explosive Limit (LEL) are equivalent terms. Upper Flammable Limit (UFL) and Upper Explosive Limit (UEL) are also equivalent terms.*

### Warnings and Cautionary Statements

Certain conditions or failure to observe certain necessary procedures will impair the performance of the instrument. These are outlined below to be read and understood by any person using the instrument.

- ⚠ Oxygen deficient atmospheres will cause erroneous low readings of combustible gas.
- ⚠ Oxygen enriched atmospheres will cause erroneous high readings of combustible gas.
- ⚠ Any rapid up-scale reading followed by a declining or erratic reading may indicate a gas concentration beyond upper scale limit which may be hazardous.
- ⚠ High off-scale readings may indicate an explosive concentration.
- ⚠ Verify the calibration of the combustible detecting mode of the instrument after use where the combustible gas content as a percent of the LEL was 100% or greater.
- ⚠ Silicone compound vapors may cause desensitization of the LEL detector and thus cause erroneous low readings. Verify the calibration of an instrument that has been used where silicone vapors were present before that instrument is relied upon for accurate measurements.

- ⚠ Obstruction of the Sensor Dust Screen will cause erroneous low readings. This screen must be kept clean.
- ⚠ Sudden changes in pressure may cause temporary fluctuations in the oxygen reading.
- ⚠ Alarms are non-latching and will automatically reset when ambient air is cleared of alarm condition.
- ⚠ Recharge battery only in a non-hazardous location.
- ⚠ Use RS-232 port only in a non-hazardous location.
- ⚠ Tested for intrinsic safety in explosive gas/air (21% oxygen) mixtures only.
- ⚠ Factory Mutual Research Corporation has not assessed the hygiene portion for performance nor verified air velocities greater than 500 ft/min.
- ⚠ An unattended instrument should be connected to an auxiliary alarm device which accomplishes the same purposes as latching.

### Unpacking

The shipping box should contain the following items. Account for each item before discarding box.

Quantity	Part No.	Description
1	1810-1774	TMX410 Multi-gas Instrument
1	1704-6343	TMX410 Instruction Manual
1	1810-1824	Leather Carrying Case
1	1704-2839	Calibration Cup
1	1704-4157	Teflon Tubing
1	1704-2946	Screwdriver/Adjustment Tool

*The following are included if instrument has Hygiene option:*

1	1704-6319	Hygiene Software Disk 5-1/4 inch
1	1704-6327	Hygiene Software Disk 3-1/2 inch
1	1704-3415	TMX410 Serial Communication Cable
1	1704-6434	DB25 to DB9 Serial Cable Adapter

After unpacking, if any item listed is missing, contact either your local distributor of ISC products, or call Industrial Scientific Corporation at: 1-800-DETECTS (338-3287) USA and Canada or (412) 788-4353.

## Familiarizing Yourself with the TMX410

A personal multi-gas detection instrument, the Industrial Scientific TMX410 monitors oxygen, combustible gas and one or two toxic gases in any configuration. The instrument recognizes and displays the installed sensors.

Specifically, the gases are:

- Oxygen
- Combustible gases (% LEL) or methane (% by volume). User selects % LEL or % CH<sub>4</sub> during span adjustment of calibration mode.
- Any two of the following toxic gases:
  - carbon monoxide
  - hydrogen sulfide
  - sulfur dioxide
  - chlorine
  - nitrogen dioxide

One external switch (MODE switch) controls normal operation. All other switches are concealed behind the calibration cover at the base of the instrument.

Three pushbutton switches (-, +, and E) are used to enter all calibration and alarm settings. There are no potentiometers to adjust.

The display illumination switch, when in the *off* position, illuminates the display only during alarm conditions. When the switch is in the *on* position, the display is continuously illuminated.

**Warning:** Continuous use of the display illumination substantially reduces run time.

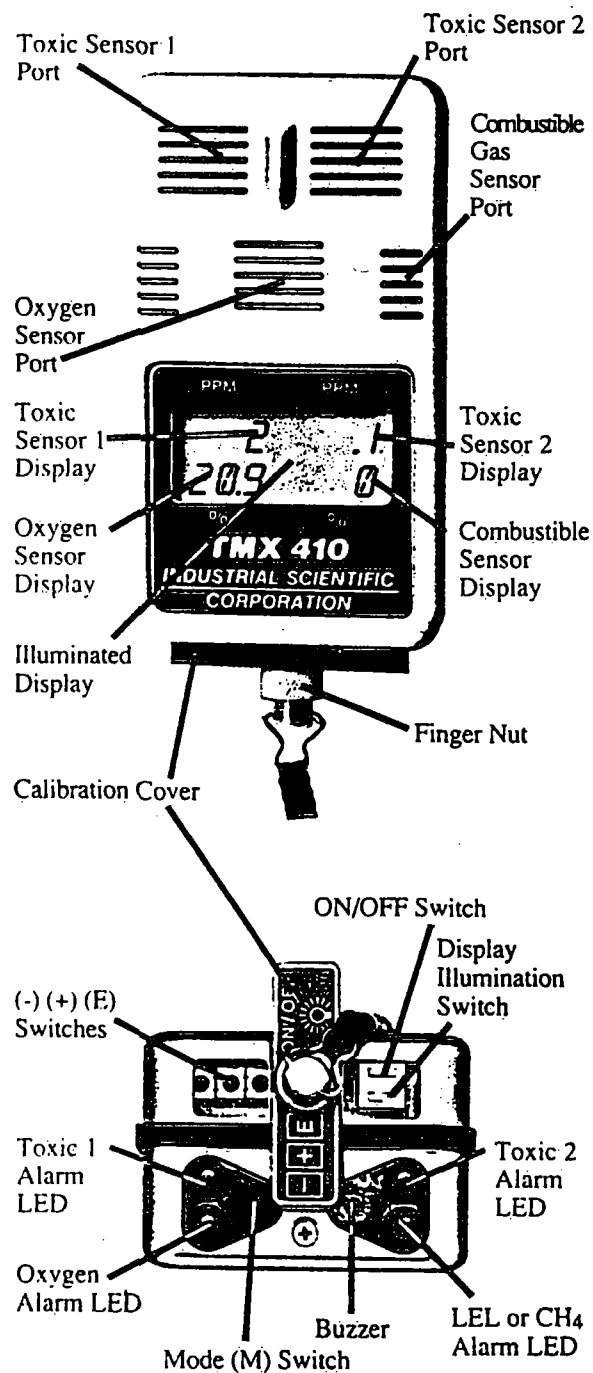
The TMX410 is powered by a rechargeable 7.5 volt nickel cadmium battery that can be easily replaced in the field.

Other TMX410 features include:

- Plug-in sensors. They can be changed or replaced without special tools or soldering.
- Toxic gas sensors. They can be selected in any single or dual combination to meet your changing needs.
- Illuminated display for easy viewing.
- A jack for connecting an optional external alarm.
- Audible and visual alarm indicators.
- High and low-level alarms for each gas.
- User-defined code. It secures calibration and alarm settings.
- Safety ON/OFF switch. It prevents the instrument from being turned off accidentally.
- Hygiene Option. It can be installed by the customer to provide short-term exposure limit (STEL) and time-weighted average (TWA) readings with data-logging capabilities.

The TMX410 is certified as intrinsically safe – or pending approval – by the following agencies:

- Underwriters Laboratories (UL)
- Canadian Standards Association (CSA)  
The Canadian Standards Association has assessed only the combustible gas portion of this instrument for performance.
- Factory Mutual (FM)
- Mine Safety and Health Administration (MSHA)
- European Committee for Electrotechnical Standardization (CENELEC)



## Charging the Battery

Before using the TMX410, fully charge the battery pack.

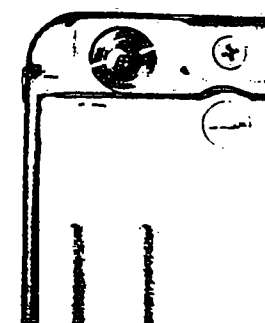
*Note: The instrument must be turned off while charging the battery.*

A single unit economy trickle (10 hour) charger is available for charging the battery in the instrument.

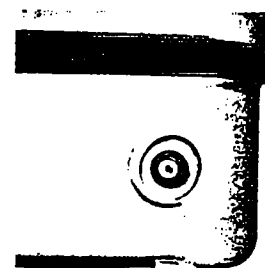
In addition to the economy charger, Industrial Scientific offers a full line of optional chargers with either high rate (4.5 hours) or trickle charging systems in single, dual, and five unit configurations and three operating voltages; all of which are capable of charging the battery pack in or out of the instrument. All high rate chargers offer a user selectable discharge before charge feature to prevent the memory condition that may result from some repetitive use patterns. There is no danger of overcharging the battery with any of these chargers. Refer to Options and Ordering Information for a complete listing of available chargers.

When charging the battery pack in the instrument, turn off the instrument and place it on the battery charger. To charge the battery pack out of the instrument, remove the battery pack from the instrument and place the battery pack on the charger (see Changing the Battery, page 34).

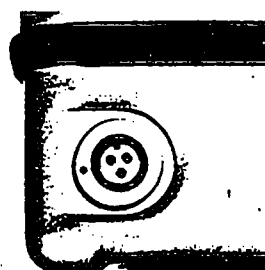
When fully charged, the battery pack will power the TMX410 for 10 hours. With approximately 30-90 minutes of run time remaining, depending on the battery condition, the TMX410 will emit a short beep once every 30 seconds. When there is an insufficient charge for the battery pack to operate the instrument, the display reads BATTERY FAIL and the instrument emits a short beep once each second. When BATTERY FAIL appears, turn off the instrument immediately. Recharge or replace the battery pack. Additional battery packs can be rotated into the TMX410 to allow round-the-clock monitoring.



Back  
Charging Jack Socket



Right Side  
External Alarm Jack

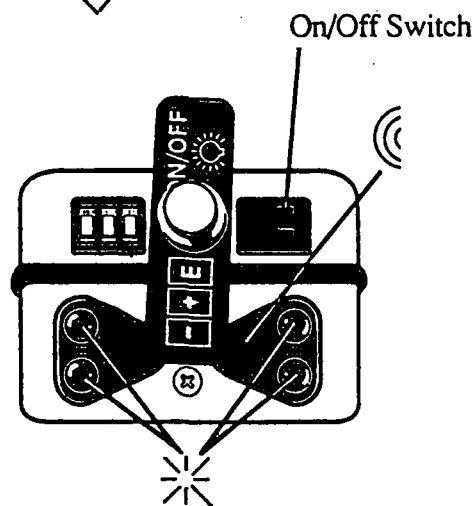
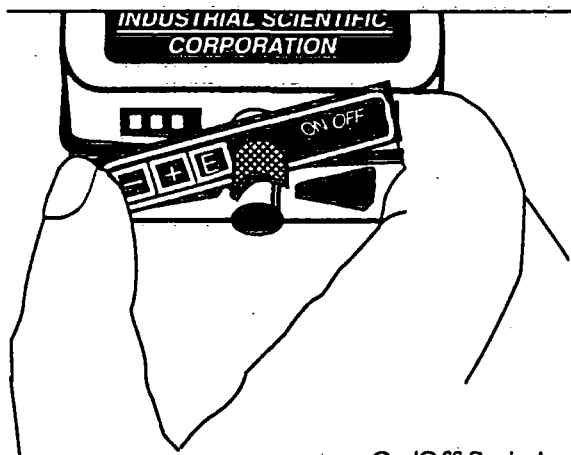
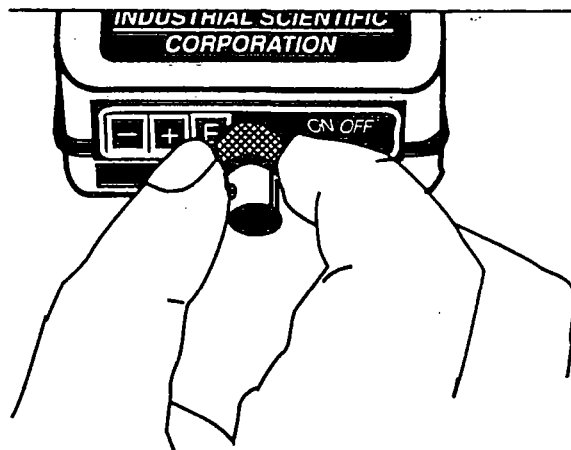


Left Side  
RS232 Port

## Turning ON the TMX410

- Loosen the finger nut at the base of the instrument and rotate the calibration cover to expose five switches.

- Slide ON/OFF switch to the left. The four LEDs will flash once and the instrument will emit a short beep.



- The following screens are displayed during the start-up sequence:

- DISPLAY TEST. All display segments are activated briefly to verify that they are operating properly.

- BATTERY. If the battery is not fully charged, the voltage reading will blink.

- SENSOR CONFIGURATION. Displays installed sensors.

- CODE. Normal startup continues without any operator response.

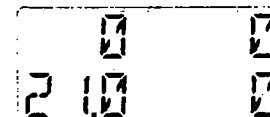
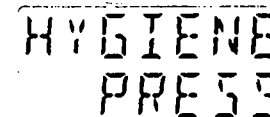
However, the calibration system can be accessed at this point by entering the correct code. (Refer to Calibrating the TMX410, see page 25.)

- HYGIENE. Normal startup continues without any operator response. A new data logging session is initiated if (E) is pressed while HYGIENE screen is displayed.

*Note: This screen only appears on instruments equipped with Hygiene Option.*

The TMX410 automatically begins operating in the Instant (default) mode. This mode displays the current levels of each installed gas.

- Reposition the calibration cover and tighten the finger nut. Never use tools to turn the finger nut. Damage or misalignment may result.

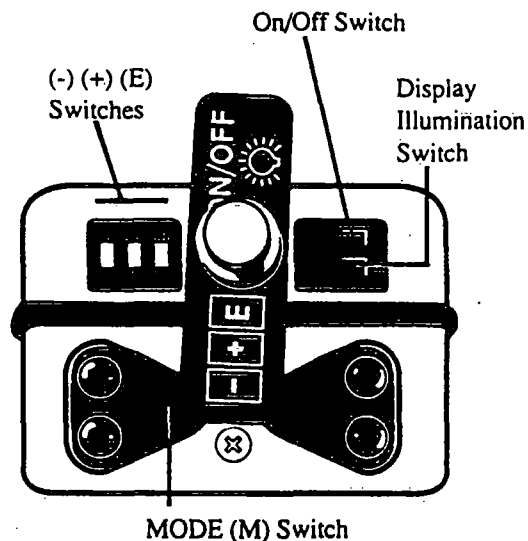


*Note: If the oxygen sensor is installed, the corresponding reading will be slightly higher than normal for about two minutes due to the sensor life extending circuitry design of the TMX410.*



## Changing Viewing Modes

• The instrument is in the Instant mode. To view the Sensor Configuration, press and hold the MODE switch. The Sensor Configuration is displayed for five seconds. If the MODE switch is released while the Sensor Configuration is displayed, the instrument will return to the Instant mode.



Continue holding the MODE switch pressed until ZERO appears to access the remaining viewing modes. To step through modes, press the MODE switch and release it when the next screen appears. Or hold the MODE switch pressed to scan them in sequence and release it on the desired MODE. Sensor Configuration is the only mode that cannot be retained. The modes are accessed in the following sequence:

—ZERO. This mode allows the user to zero the instrument and span oxygen without accessing the calibration system.

ZERO  
PRESS

—PK (Peak Readings). This mode displays the highest measured levels of installed combustible and toxic gases, as well as the lowest measured level of oxygen, since the peaks were cleared last.

65P 8  
19.3K 12

—PEAKS. Provides operator the opportunity to clear peak values. Scrolled prompt reads: PRESS (E) TO CLEAR.

PEAKS  
PRESS

—BATTERY. This mode displays the battery voltage.

BATTERY  
742 V

After BATTERY, the standard TMX410 repeats the mode sequence beginning with Instant Readings. If the instrument is equipped with the Hygiene option, the sequence continues with the following viewing modes:

—RT LT (Hygiene Clock). The Real Time (RT) clock is displayed on the top line and the Log Time (LT) clock on the bottom line.

RT 16:00  
LT 08:45

—TWA. This mode displays the Time Weighted Average values of installed toxic gasses.

38 5  
TWA

—STEL. The Short Term Exposure Limit values of installed toxic gasses are displayed.

200 15  
STEL

After STEL, the sequence repeats beginning with the INSTANT mode.

## Using the Zero and Peak Value Functions

### —To Zero Instrument and Span Oxygen

The instrument may be zeroed and the oxygen sensor, if installed, spanned without need of accessing the calibration procedure.

**Warning:** Only zero the instrument in clear air having normal oxygen concentration.

- Press and hold the MODE switch until the ZERO screen appears.

- Press (E) to start the Zeroing Function. The instrument returns to the Instant Readings mode when Zeroing and Oxygen Span is completed.

### —To Zero Instrument and NOT Span Oxygen

- Press and hold the MODE switch until the ZERO screen appears.

- Press (E) to start the Zeroing Function.

- Wait 15 seconds and press MODE. The instrument returns to the Instant Readings mode without spanning the oxygen sensor.

### —To Clear Peak Reading Values

The TMX410 continually saves the highest measured values of toxic and combustible gasses and the lowest measured value of oxygen and displays them in the Peak Readings mode. To clear the peak values:

- Press and hold the MODE switch until the PEAKS screen with scrolled message appears.
- Press (E) to clear peaks. The instrument returns to the Peak Readings mode indicating the peaks have been cleared.

## TMX410 Hygiene Functions

### Definition of Terms

**Data Log**—Record of measured gas concentrations, including the time and date, stored in electronic memory.

**Logging Session**—One or more periods of normal instrument operation between hygiene function resets.

**Period**—The logging time that begins when the instrument is turned on and starts normal operation and lasting until the instrument is turned off.

**Real Time Clock**—A clock function that maintains the current time.

**Log Time Clock**—A clock function that monitors the amount of time logged during a session.

**Calendar**—A part of the real time clock function that maintains the current date.

**TWA**—(Time Weighted Average) The accumulated gas exposure averaged over a predetermined time, typically eight hours.

**STEL**—(Short Term Exposure Limit) The accumulated average value of gas exposure for the preceding fifteen minutes.

### Principles of Operation

If the TMX410 is equipped with the hygiene option, all instantaneous readings of installed sensors are sent to the hygiene module. Once a minute their averaged values are saved to the

data log and the TWA and STEL values are calculated for the toxic gas sensors. The TWA and STEL values are then checked for possible alarm conditions.

The default time base for calculating TWA values is eight hours. However, the time base may be changed to any integer value in the range of one to forty hours using the supplied computer software.

The 130,816 byte memory provides storage capacity for approximately one hundred and ten hours of logged data with four sensors installed. The data logging section of the instrument is always powered and a battery backup circuit protects from loss of data for one half hour during battery changes.

### Beginning a New Logging Session

- Turn *on* the instrument (see pages 12-13) and follow the start-up sequence.
- When the HYGIENE screen appears, the scrolled prompt reads: PRESS (E) TO RESET. Press (E) to clear the hygiene functions and start a new logging session. The instrument may be switched *off* and *on* as many times as is necessary without resetting the hygiene functions.

*Note: Low Memory Indication—If, when a new Logging Session is initiated, there is not enough available memory to log approximately twelve hours of readings, the Real Time (RT) clock displays "RTOR:OR" following the reset. To avoid loss of data, turn the instrument off. Download all logged sessions and reset the hygiene data log (see Downloading and Setting the TMX410, see pages 19-22).*

### Clearing Low Memory Indication

**Warning:** Using this method to clear the low memory indication will erase all data that has not been downloaded.

- Turn the instrument *on* and press (E) at the HYGIENE screen. The low memory status is cleared and session number one is initiated starting a new data log.

## Marking Periods in a Session

A break is recorded in the data log at the beginning of every session and each time the instrument is turned off and later turned on without resetting the hygiene. When downloading data, the download operation stops at every break to allow comments to be entered.

- Turn *on* the instrument and allow the start-up sequence to run through completion. When normal operation begins, switch to the Hygiene Clock mode and note the time and any other information you may wish to add to the log while downloading.

## TMX410 Hygiene Software

The software programs supplied with the TMX410 Hygiene option is designed to run on any IBM PC XT, AT, PS/2<sup>(1)</sup> or compatible with at least 640k of RAM and a hard disk drive.

Before proceeding, make a work copy of the distribution disk and store the distribution disk in a safe place.

## Installing Software on Hard Drive

*Note: After the initial installation, it should only be necessary to repeat this procedure if a new software revision is issued.*

- Insert a work copy (5¼ or 3½ inch) of the software into the appropriate floppy drive.
- Log onto the drive; type `install` and press `<ENTER>`. The Install program will create a directory on the C drive called TMX410 and copy all of the TMX410 programs to the TMX410 directory. A batch file named "tmx.bat" is copied to the root directory.

## Running TMX410 Software

*Note: If the software programs have not been installed on the hard drive, see Installing the Software on the Hard Drive, see page 18.*

- Log onto the C: drive root directory.
- Type `tmx` at the C: prompt and press `<ENTER>`.

<sup>(1)</sup>IBM PC XT, AT and PS/2 are registered trade marks of International Business Machines Corporation.

## Downloading and Setting the TMX410

- From the MAIN MENU, press `<1>`. The screen prompt reads: Connect the TMX410 communication cable to either COM1 or COM2.
- Plug the twenty-five pin connector of the supplied cable into either the COM1 or COM2 serial communication port of the computer. If the computer has a nine pin serial port, use the supplied adapter. The cable may remain connected to save time later.
- Press any key. The screen prompt reads: Select proper serial communication port by pressing `<SPACE>`. If the cable is connected to COM2, press the `<SPACE>` bar to select port.
- Press `<ENTER>` after selecting the correct port. The screen prompt reads: Verify that TMX410 is turned *OFF*. Then, plug communication cable into RS-232 port on TMX410.
- With the instrument turned *off*, plug the other end of the communication cable into the TMX410 serial port. Observe the polarizing marks on the connector and jack. Press any key.
- Turn *on* the TMX410. After the computer acknowledges communication with the instrument, the DOWNLOAD MENU appears.

### —To Download Logged Data

- From the DOWNLOAD MENU, press `<1>`. The number of sessions available for downloading, user instructions, and the "Download session number [?]" prompt are displayed. Logging sessions are downloaded in ascending order beginning with session number [1]. You may change the session number selected for download by typing the new number at this time. Use the backspace key for corrections. Press `ENTER` when ready. New user instructions and the "File name [ ]" prompt appear.

- Type the file name under which the session (record) is to be saved. Any valid DOS file name may be used. If you wish to save the file in a different directory, you must also include the drive letter and path. Consult your DOS users manual for further information on directories and file names.

- Press <ENTER>. The message "Searching Data Log for session [?]" is displayed. After the session is located, the messages "Saving session to disk with file name [your file name]" and "The colon (:) denotes the start of each logging period. A comment of up to 65 characters may be entered at the colon. Use backspace to make corrections. Press ENTER to continue downloading." A line of numbers will appear followed by a colon (:) on the next line.

- You may type a comment into the log at this time.

- Press <ENTER> to continue downloading the session to the disk file.

*Note: Downloading will halt for comment entry every time a colon is encountered in the data log. A colon is inserted into the log to mark each period in the session. Press <ENTER> to continue.*

After the session has been downloaded, the first download screen returns indicating that the next session is ready for download. When you have finished downloading sessions, press <ESC> key to return to DOWNLOAD MENU.

#### —To Reset Hygiene Data Log

- From the DOWNLOAD MENU, press <2>. The screen prompt reads: Press ENTER to clear TMX410 Datalog/ Hygiene. The number of available sessions is also displayed.

- Press the <ENTER> key. The number of sessions displayed will change to [0] indicating that the datalog and hygiene functions in the TMX410 have been reset. Press <ESC> to return to DOWNLOAD MENU.

#### —To Check or Set the Real Time Clock

- From the DOWNLOAD MENU, press <3>. The TMX410 time is displayed in 24 hour format. The prompt reads: Enter new time in 24 hour format hh:mm.

- Enter the time in twenty-four hour format. Example: To set the time to 9:06 am, type 0906. If you make a mistake, press the <BACKSPACE> key and retype.

- Press <ENTER> to set the new time. The displayed TMX410 time will change to the new time. Press <ESC> to return to DOWNLOAD MENU.

#### —To Check or Set the Calendar

- From the DOWNLOAD MENU, press <4>. The current TMX410 date is displayed in month-day-year format. The prompt reads: Enter new date mm-dd-yy.

- Enter the new date using the month-day-year format. Example: To set the date to March 5, 1992, type 030592. If you make a mistake, press the <BACKSPACE> key and retype.

- Press <ENTER> to set the new date. The displayed TMX410 date will change to the new date. Press <ESC> to return to DOWNLOAD MENU.

#### —To Check or Set the TWA Time Base

**Warning:** When setting a new TWA time base, always calibrate the instrument TWA and STEL alarm settings accordingly (see Changing Alarm Settings, page 30).

- From the DOWNLOAD MENU, press <5>. The current TWA time base is displayed in hours. The prompt reads: Enter new TWA time base and press ENTER to change.

- Enter the new TWA time base in hours (value from 1 to 40 will be accepted). If you make a mistake press the <BACKSPACE> key and retype.

- Press <ENTER> to set the new TWA time base. The displayed TWA time base will change to the new value. Press <ESC> to return to DOWNLOAD MENU.

#### —To Exit Download Menu

- Press <ESC> key. The screen prompt reads: Switch OFF the TMX410 and disconnect the communication cable from the instrument.
- Switch OFF the instrument.
- Grasp the barrel of the RS232 connector and pull gently to disconnect the cable.
- Press any key. The prompt reads: Download another instrument? Y/N. If "Y" is pressed, the above sequence is repeated for another instrument. Press "N" to return to MAIN MENU.

#### Retrieve and Analyze Data

- From the MAIN MENU, press <2>. The screen prompt reads: Enter the name of the file to be retrieved:
- Type the file name you wish to retrieve. If the file is not in the current drive and directory, include the drive letter and directory name.
- Press <ENTER>. The file is loaded and the UTILITIES MENU appears on the screen.

#### —To Display Data

- From the UTILITIES MENU, press <1>. The page (1) of the data is displayed.
- Press <Page Down> to view the next data page.
- Press <Page Up> to view the previous data page.
- Press <ESC> to return to the UTILITIES MENU.

#### —To Print Data

- Verify that printer is connected and turned on.
- From the UTILITIES MENU, press <2>. The data file is printed. If a printer error is encountered, it will be indicated on the screen. After printing the file, the UTILITIES MENU returns.

*Note: Printing may be interrupted at any time by pressing <I>.*

#### —To Save Data to Disk in Lotus Format

- From the UTILITIES MENU, press <3>. The prompt "Enter the name of the file to be created" is displayed.
- Type the name of the Lotus file you wish to create and press <ENTER>. After the Lotus file has been created, press any key to return to the UTILITIES MENU.

#### —To Print the STEL and TWA Values

- From the UTILITIES MENU, press <4>. When the printing terminates, the UTILITIES MENU returns.

*Note: Printing may be interrupted at any time by pressing <I>.*

#### —To Enter Data Summary Mode

- From the UTILITIES MENU, press <5>. The DATA SUMMARY menu appears.

#### —To Display Data Summary

- From the DATA SUMMARY menu, press <1>. The Data Summary is displayed. Press any key to return to DATA SUMMARY menu.

#### —To Print Data Summary

- From the DATA SUMMARY menu, press <2>. The message "Data Summary is Being Printed" is displayed. When the printing is completed, the DATA SUMMARY menu returns.

*Note: If the Printer Error is displayed, check that printer is connected and ready for printing.*

- Press <ESC> to return to UTILITIES MENU.

#### —To Enter Graphics Mode

- From the UTILITIES MENU, press <6>. The GRAPHICS MENU appears.

#### —To View Standard Scale Graphics

When graphs are viewed in standard scale, the vertical and horizontal scales are selected by the graphics program.

- From the GRAPHICS MENU, press <1>. The STANDARD SCALE GRAPHICS MENU appears.

- Press the indicated number to select a graph for viewing. Menu selections will vary according to the type and number of sensors installed in the TMX410.

- Press and hold the <CTRL> key while pressing <P> to print the graph.

- Press <ESC> to return to STANDARD SCALE GRAPHICS MENU.

- Press <ESC> to return to GRAPHICS MENU.

#### —To View Selectable Time Scale Graphics

When graphs are viewed in selectable time scale, the vertical scale is automatically set to the highest value for the graph and the time scale may be changed to view a selected portion of the graph.

- From the GRAPHICS MENU, press <2>. The SELECTABLE TIME SCALE GRAPHICS MENU appears.

- Press the indicated number to select a graph for viewing. Menu selections will vary according to the type and number of sensors installed in the TMX410.

- Press <S> to scale graph. A box appears in the upper right hand corner of the graph.

- Type in the start hour of scaled graph and press <ENTER>.

- Type in the start minute of scaled graph and press <ENTER>.

- Type in the end hour of scaled graph and press <ENTER>.

- Type in the end minute of scaled graph and press <ENTER>. The scaled graph is displayed.

- Press and hold the <CTRL> key while pressing <P> to print the graph.

- Press <ESC> to return to SELECTABLE TIME SCALE GRAPHICS MENU.

- Press <ESC> to return to GRAPHICS MENU.

#### —To Select Printer & Add/Delete Graph Summary

- From the GRAPHICS MENU, press <3>. The print status and options menu appears.

- Press <1> to select a printer driver. The list of available printer drivers appears.

- Select the appropriate driver by pressing the indicated number.

- Press <Y> to confirm your selection. The new driver is loaded and the DOS prompt appears. Type TMX and press <ENTER> to restart the program with the new printer driver installed.

- Press <2> to add or delete the graph summary from printed graphs.

#### —To Select Black and White or Color Graphics

- From the GRAPHICS MENU, press <5>. If setting was for black and white, color is selected. If setting was for color, black and white is selected.

#### —To Enable and Disable Optional TWA Time Base

You may wish to disable the optional TWA time base setting used in many of the utilities.

- From the UTILITIES MENU, press <7>. If the option was enabled, it is disabled. If the option was disabled, it is enabled.

### Calibrating the TMX410

To ensure maximum safety, perform a calibration check on the TMX410 prior to each use. Calibration equipment is available from Industrial Scientific.

To obtain the highest calibration accuracy, the monitor should be allowed to stabilize at room temperature for at least one hour before calibration.

*Note: It is recommended that the oxygen span calibration be performed in clean air containing 20.9% oxygen. Use of oxygen calibration gas may cause erroneous readings due to changes in relative humidity.*

*If you are measuring a known combustible gas, use a known % LEL concentration of that gas for span calibration. For general combustible gas measurement, Industrial Scientific Corporation recommends calibrating to pentane in the 15-50% LEL range. Note that the measured LEL concentration of gases other than the calibration gas may not correspond one to one with the meter reading. Calibration gas flow rate should be between 0.5 and 1.0 liter per minute (Apply 1.0 liter per minute for chlorine).*

### Accessing the Calibration Procedure

In order to calibrate the instrument, you must enter the correct code. All TMX410 instruments are factory-programmed with code 0.

Following are the steps for calibration:

- Make sure the battery is fully charged.
- Turn on instrument (see pages 12-13) and follow the start-up sequence.
- When the CODE screen appears, the number 0 is displayed. The scrolled prompt reads: PRESS (+) or (-) TO SET (E) TO ENTER (M) TO EXIT. If the access code has been changed to a number other than zero, you must set the correct number on the display by pressing (+) or (-) accordingly.
- Press (E) to enter set code. The Calibration Procedure is accessed.

*Note: The Calibration Procedure is exited by pressing the MODE switch from any of the four main function screens. Upon exit, normal instrument operation begins in the Instant Viewing Mode. To access the Calibration Procedure again, first turn off the instrument. Wait a few seconds. Turn on the instrument and repeat the sequence described above.*

CODE 0  
PRESS

The Calibration Procedure consists of four functions identified by the following screens:

ZERO  
SPAN  
ALARMS  
CODE

The scrolled prompt PRESS (+) TO STEP (E) TO SELECT (M) TO EXIT appears on each screen.

*Note: If the Hygiene option is installed, span calibration of any gas or changing any TWA or STEL alarm setting will cause the hygiene functions to reset upon exiting the calibration procedure. However, viewing the alarm settings will not cause a reset.*

### Zeroing the Instrument

- To select ZERO, press (E) when the word appears on the display. At this point, the scrolled prompt reads: PRESS (E) TO START (M) TO EXIT.

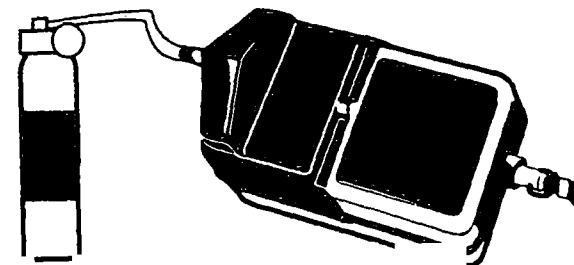
ZERO  
PRESS

- Press (E) to start zeroing sequence on room air. The room air must not contain any trace of toxic or combustible gas that would cause the instrument to respond. If the air purity is uncertain, use bottled zero grade air to zero the instrument.

The instrument remains in the zeroing cycle for two minutes. During the cycle, the word ZEROING is displayed and the scrolled prompt reads: PRESS (M) TO EXIT. To zero the instrument on bottled zero grade air, apply gas before pressing (E).

ZEROING  
PRESS

*Note: APPLY GAS means connecting the calibration cup to the appropriate calibration gas cylinder. Place the calibration cup on the instrument as shown.*



- At the end of the two-minute period, the combustible and toxic gases are zeroed. The instrument then emits a short beep and returns to the ZERO screen.

## Span Calibration

**Warning:** Zero the instrument before calibrating any combustible or toxic gas spans.

- Press (+) to advance from the ZERO screen to the SPAN screen. Press (E) to select the span sequence.
- Press (+) to step through the available gases. The name of the gas and the current reading are displayed as each gas is accessed. Only installed sensors are accessed. (H<sub>2</sub>S is used in the accompanying illustration as a typical example.).

Press (E) when the desired gas is displayed.

- The last used span concentration is displayed and the gas identifier blinks, indicating that the displayed gas has been selected for calibration. The scrolled prompt reads: PRESS (+) OR (-) TO SET (E) TO ENTER (M) TO EXIT.
- Press (+) or (-) to adjust the displayed number so that it reads as closely as possible to the concentration printed on the calibration gas cylinder.
- Press (E) to enter the set concentration. When the instrument accepts the number, the gas identifier stops blinking and the scrolled prompt reads: APPLY GAS PRESS (E) TO START (M) TO EXIT.

SPAN  
PRESS

0 H2S  
PRESS

26 H2S  
PRESS



25 H2S  
PRESS

25 H2S  
APPLY

- Apply the span gas\* then press (E) to start the automatic span cycle. During the span cycle, the gas reading is displayed to full span sensitivity. A value greater than the span gas concentration indicates reserve sensitivity.

32 H2S  
PRESS

*Note: When calibrating for chlorine or nitrogen dioxide, always use teflon tubing.*

When the automatic span cycle ends, the instrument will respond to one of the following conditions:

- The sensor sensitivity is at least seventy percent that of a new sensor. A short beep is emitted, verifying that calibration has occurred. The instrument returns to the gas identifier screen and displays the current measured value.

25 H2S  
PRESS

- The sensor sensitivity is less than seventy but greater than fifty percent that of a new sensor. A short beep is emitted. The instrument is spanned and returns to the gas identifier screen. However, the current value flashes until the screen is changed, indicating that the sensor should be replaced soon.

25 H2S  
PRESS

- The sensor sensitivity is less than fifty percent that of a new sensor. The calibration FAIL Screen appears and a fault alarm sounds until a key switch is pressed. To calibrate the instrument, a replacement sensor must be installed. If the instrument is not recalibrated, a sensor fail will be indicated during normal operation.

FAIL H2S  
PRESS

*Note: When failed calibration occurs or low sensitivity is indicated, always verify that the calibration gas cylinder did not empty during calibration.*



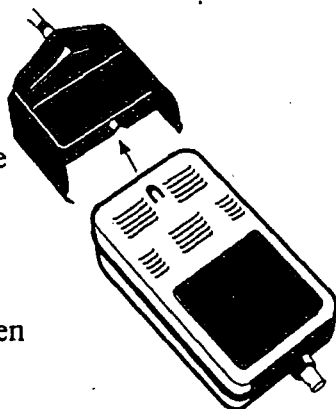
- After the calibration sequence, turn off the calibration gas cylinder and remove the cup from the instrument.
- Follow the same procedure to calibrate other available gases as desired.

## Changing Alarm Settings

- Press (+) to advance from SPAN screen to ALARMS screen.
- Press (E) to select ALARMS. The INSTANT screen then appears. The scrolled prompt reads: PRESS (+) TO STEP (E) TO SELECT (M) TO EXIT.

*Note: Alarm settings are divided into three groups: INSTANT, TWA, and STEL. Only INSTANT alarm settings are available in the standard TMX410. Select the desired group by pressing (+) until the group heading appears. Press (E) to access the alarms of that group. (The procedure is the same for all groups; INSTANT alarms are used as a typical example.)*

- To access the Instant alarms, press (E). The current low-level alarm setting of the first available gas then appears on the display.
- Pressing (+) allows you to step through the current alarm settings for all available gases. The display will identify the gas and INSTANT alarm type as either high (H) or low (L). TWA and STEL modes have only one alarm setting.



ALARMS  
PRESS

INSTANT  
PRESS

10LH25  
PRESS

- To change any alarm setting, press (E) when the desired alarm is displayed. The gas identifier then blinks, indicating that you may change the existing alarm. The scrolled prompt reads: PRESS (+) OR (-) TO SET (E) TO ENTER (M) TO EXIT.

- Press (+) or (-) to change the alarm setting.
- Press (E) to enter the new setting. The display then stops flashing.

*Note: When (M) is pressed at any stage in the ALARMS sequence, the TMX410 reverts to the preceding screen until it exits the Calibration Procedure and returns to the Instant mode.*

- Follow the same procedure to change the alarms for any available gas as desired.
- When you have completed your changes, press (M) to return to the Instant screen.
- Press (+) to step to a different group, if applicable, or (M) to return to the ALARMS screen.

## Changing the Access Code

The original access code is factory-programmed at the number 0. Any other code number from 0 to 999 can be selected.

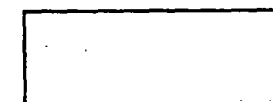
**Warning:** Before entering a new access code, record the new code number in the space at right or a safe place. Once you exit the Calibration Procedure, it cannot be accessed again without entering the correct code.

- Press (+) to advance from the ALARMS screen to the CODE screen.

10LH25  
PRESS

SLH25  
PRESS

SLH25  
PRESS



CODE  
PRESS

- Press (E) to select the code change option. The present code is displayed. The scrolled prompt reads: PRESS (+) or (-) TO SET (E) TO ENTER (M) TO EXIT.

CODE 0  
PRESS

- Press (+) or (-) to change the displayed code to the desired number.

CODE 123  
PRESS

- Press (E) to enter the new code. The display returns to the CODE screen.

CODE  
PRESS

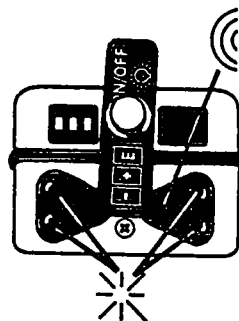
- To verify the new code, press (E). The code is displayed. Press (M) to exit.

CODE 123  
PRESS

## Description of Alarm Indicators

### HIGH-LEVEL ALARMS

When a monitored gas reaches the high-level instant or STEL alarm setting, the instrument emits a high-pitched warbling tone. Simultaneously, a bright red LED flashes at the base of the instrument. The specific LED corresponds to the position of the gas on the display.



The displayed value of the alarming gas blinks when the viewing mode corresponds to the alarm type (e.g. INSTANT or STEL). In addition, the display backlight is lit for easier reading in a dark environment.

### LOW-LEVEL ALARMS

When a monitored gas reaches the low-level instant or TWA alarm setting, the instrument emits a short beep at 1.2 seconds intervals and the corresponding LED and display backlight flash simultaneously. The displayed

0 15  
2 10 0

value of the alarming gas blinks when the viewing mode corresponds to the alarm type (e.g. INSTANT or TWA).

*Note: The TMX410 does not have a low-level alarm for oxygen. Oxygen low alarm signals oxygen deficiency and is implemented as a high-level alarm.*

### OVER RANGE INDICATION

An over range condition is when a sensor reading exceeds the upper limit of the Measuring Range (See Specifications) and is indicated by "OR" in the appropriate display location.

### LOW BATTERY WARNING

With approximately 30-90 minutes of run time remaining, depending on the battery condition, the TMX410 will emit a short beep once every 15 seconds.

*Note: The optional External Alarm will emit its own low battery warning that beeps every 3-4 minutes.*

### BATTERY FAILURE

When the battery has insufficient charge to operate the instrument, BATTERY FAIL is displayed. The instrument stops monitoring and emits a short beep once each second.

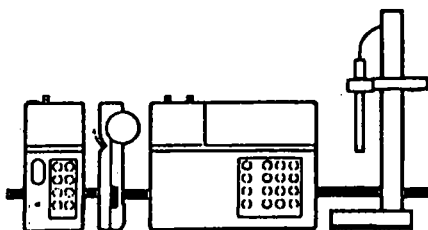
When BATTERY FAIL appears, turn off the instrument immediately. Recharge or replace the battery.

BATTERY  
FAIL

### FAULT INDICATION

If, when the TMX410 is turned on, a newly installed sensor does not agree with the valid sensor type for that position, the instrument emits a short beep once each second. The corresponding display position also will be blank. The same fault indication is indicated when a toxic or combustible sensor becomes disconnected or a combustible fault is detected during normal operation. Sensor types become valid only after calibration.

**OPERATION AND CALIBRATION INSTRUCTIONS  
FROM  
INSTRUCTION MANUAL FOR  
ORION PORTABLE pH/ISE METER  
MODEL 250A**



## Chapter I. Introduction

Orion's Portable Meters are compact, battery operated and microprocessor controlled for all measurement needs. All meters feature a custom digital LCD display which simultaneously displays temperature along with measurement results. Ideal for field, plant, or laboratory use each meter is lightweight and designed to fit comfortably in the hand. A flip stand allows easy use in the lab.

The model 230A is a pH meter which features autocalibration and automatic temperature compensation.

The model 250A has all the features of the 230A plus a millivolt and relative millivolt mode, and RS232-C output for use with the Orion 900A printer or other serial peripherals.

The model 290A adds concentration measurements and an internal datalogging function to make a truly versatile meter for pH or ISE analysis.

This manual contains instructions for all three meters. See the calibration and measurement section for details on your particular meter. The general information section contains descriptions of hardware which pertain to all meters. The Temperature Compensation and Troubleshooting sections contain information applicable to all meters.

## Chapter II. General Information

### General Description

Orion's Portable Meters have a large custom LCD display and keypad with tactile and audible feedback. Designed for one-handed operation each features an electrode clip to attach electrode directly to meter and molded grip area. (Electrode clips included in Portable Meter Starter Kit, Orion Cat. No. 0PBLSK)

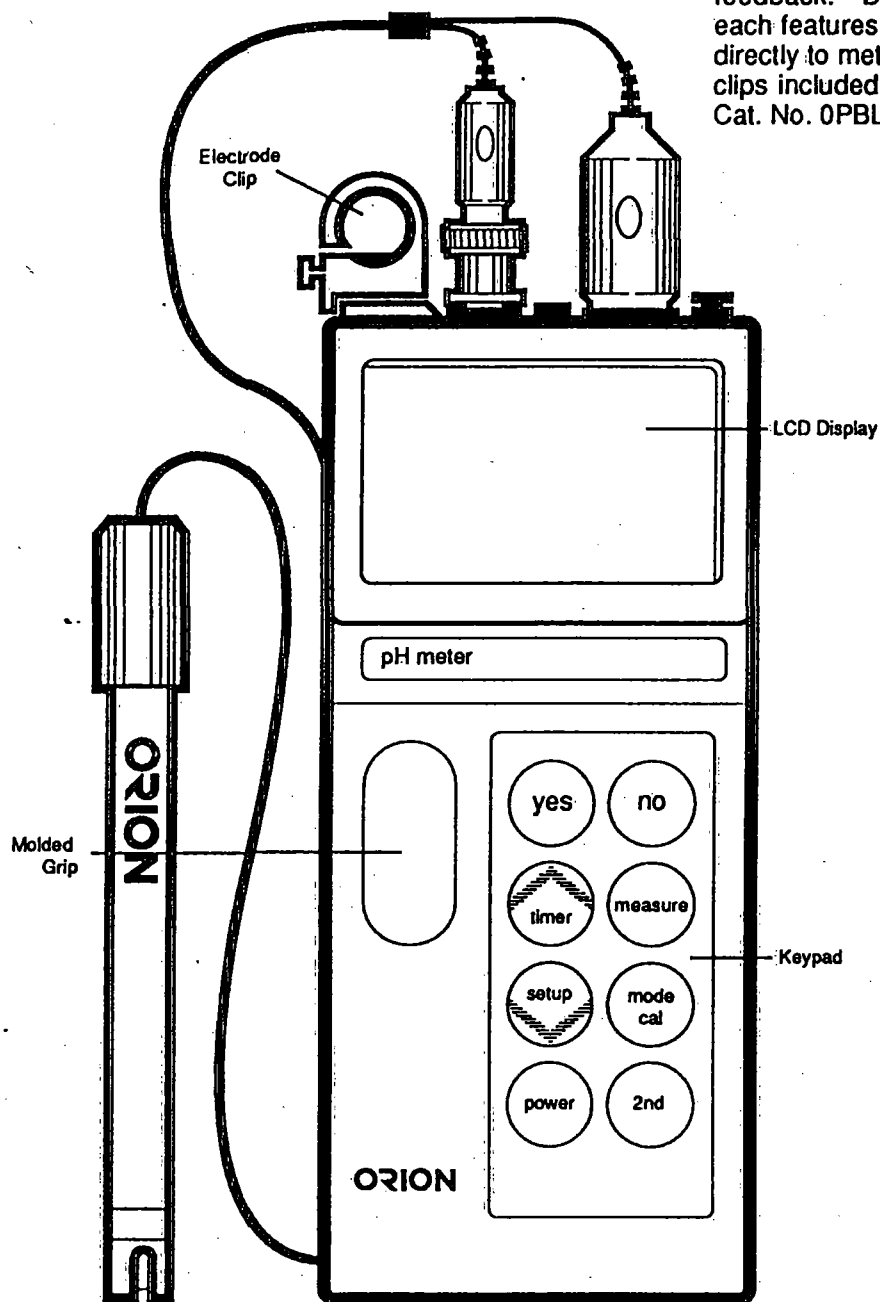


Figure 1

## Top Panel

1. **Electrode Connections:** Accepts BNC connector from combination or sensing electrode(s) (1A), A separate pin tip (1B) accepts a reference electrode.
2. **ATC Probe Jack:** Accepts thermistor type Automatic Temperature Compensation probe with DIN connector.
3. **Line Converter Jack:** Accepts an AC line converter for use without batteries.

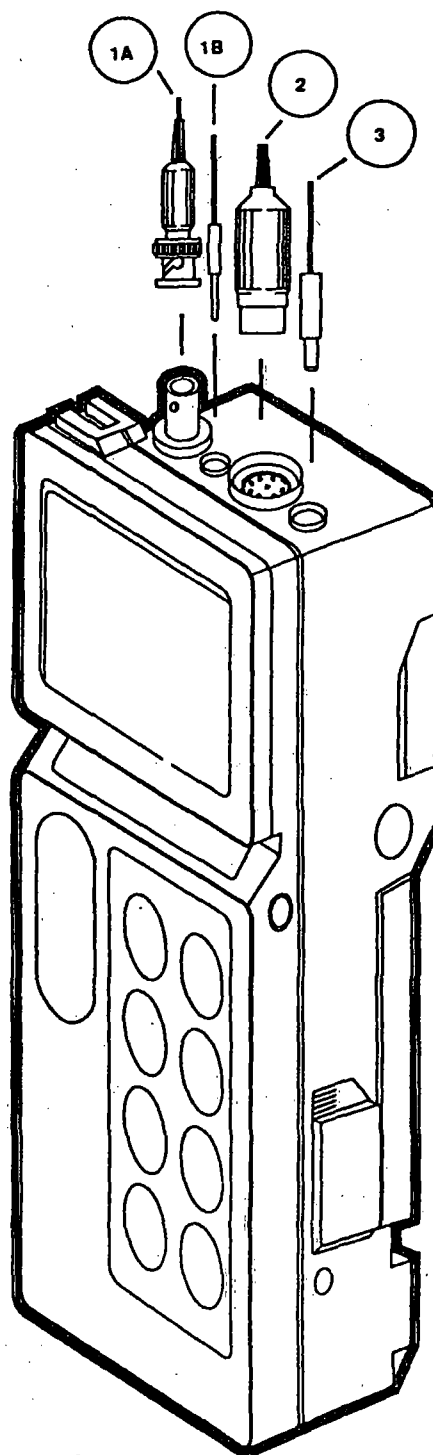


Figure 2

### Rear Panel

1. **Battery Compartment:** Accepts one 9 V battery, either alkaline or lithium.
2. **Setup Menu Label:** Identifies setup parameters and corresponding I.D. codes.
3. **Electrode Clip:** Attaches an electrode directly to the meter for one handed operation.
4. **Electrode Storage Compartment:** Stores electrode in between measurements. Compartment can contain electrode storage solution to keep electrode moist and ready for use.
5. **Cable Management:** The cable(s) from the electrode(s) will slide under the left side of the storage compartment.

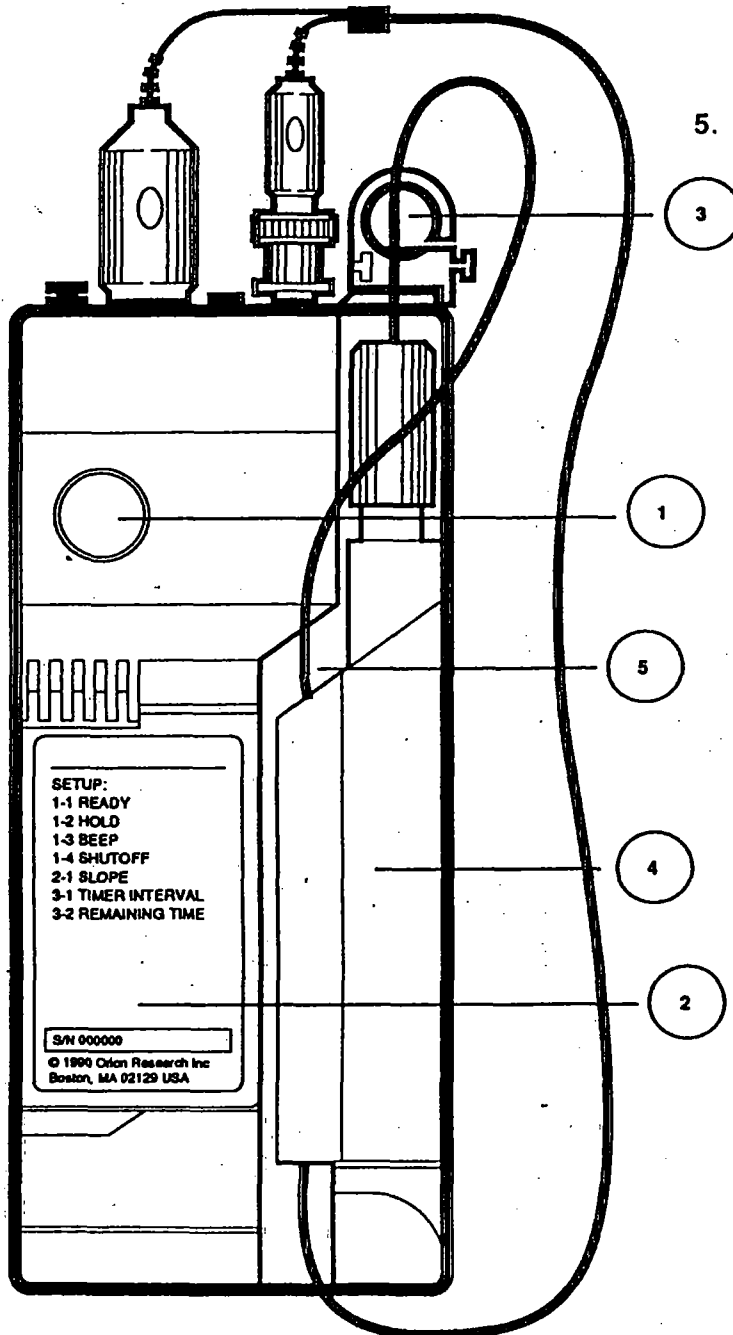


Figure 3

## Electrode Clip

The electrode clip allows easy one-handed dip and read operation. Two or more electrodes may be joined together and then attached directly to the meter.

1. Slide electrode clip onto electrode.
2. If using two electrodes slide second electrode clip into opening on the first electrode clip.
3. Attach electrode(s) to meter by sliding clip from left to right into meter until securely seated.

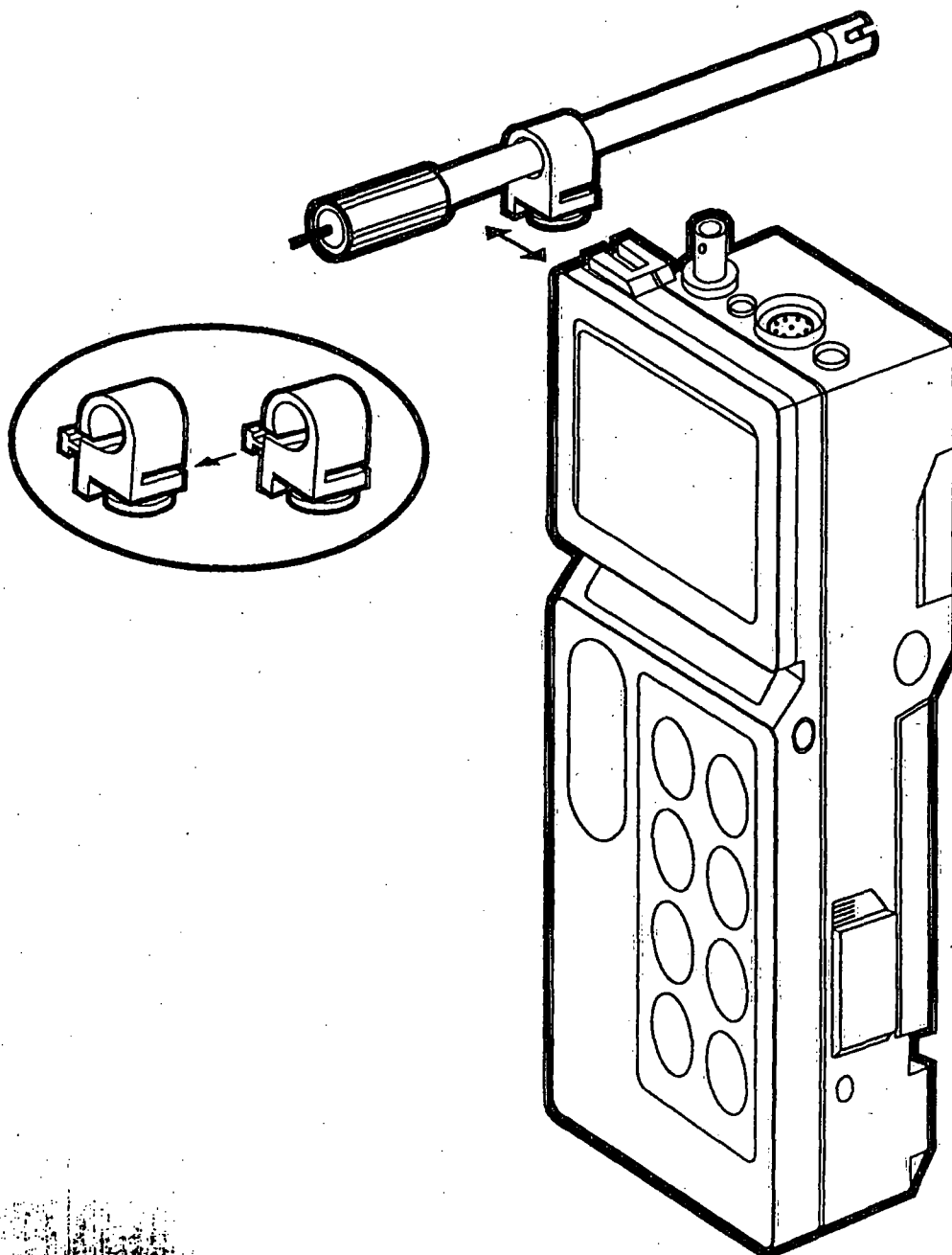


Figure 4



## Electrode Storage Compartment

The electrode storage compartment provides a convenient place for electrode storage between measurements and in the field. Add a few drops of pH electrode storage solution Orion Cat No. 910001 to the storage compartment cap to ensure your electrode will be ready for use. The entire compartment is removable for easy cleaning.

The left hand side of the compartment (when the meter is turned over and facing down) provides a space for the electrode cables. Slide the cable underneath the edge of the compartment.

1. With the meter facing down slide the compartment to the right to remove.
2. Rinse with distilled or deionized water.
3. Replace compartment by lining up pins on meter with slides on electrode storage compartment then slide to the left until firmly in place.

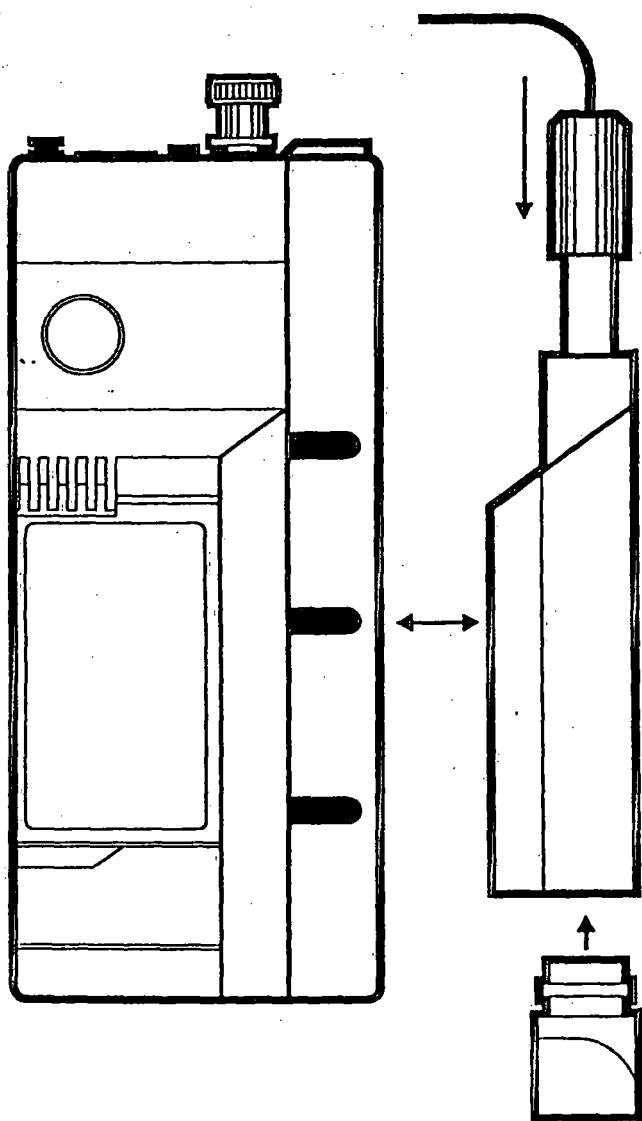


Figure 5

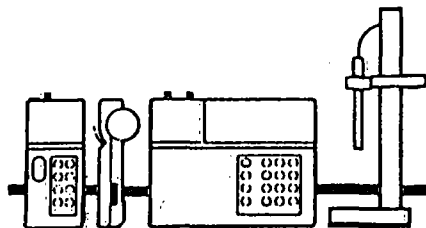
## **RS232-C Interface**

Both the Model 250A and 290A have an RS232-C Interface for use printers or serial peripherals.

The Model 250A has a one way Interface for communication with the Orion 900A printer or other device. The instrument can send (but not receive) information via this port.

The Model 290A has a bi-directional Interface for communication with printers or computers. The instrument can send or receive information using this port.

The Model 900A printer is battery operated and attaches directly to either meter making a compact package for field measurement and recording. See printer manual, part no. 213377-001



## Chapter III. Instrument Setup

### Power Source

The Orion Portable Meters operate on either one 9 V alkaline battery, one 9 V lithium battery, or an AC line adapter. The estimated battery life is 50 hours of continuous operation for an alkaline battery and 100 hours of continuous operation for a lithium battery. Insert battery as described below or plug in the line adapter.

### Battery Installation

1. Open battery compartment by pushing closure up. This is most easily accomplished by using a coin (such as a dime) and inserting it into the slot on the side of the meter.
2. Insert battery pushing gently until it locks in place. Ensure polarity is correct as shown in the battery compartment.
3. Replace battery compartment cover.

**NOTE:** After replacing the battery recalibrate. Without the battery installed or meter plugged into line power the meter loses calibration data and other information in memory. To prevent loss of data in the field turn meter off if the low battery signal comes on. Check and replace batteries regularly prior to field use.

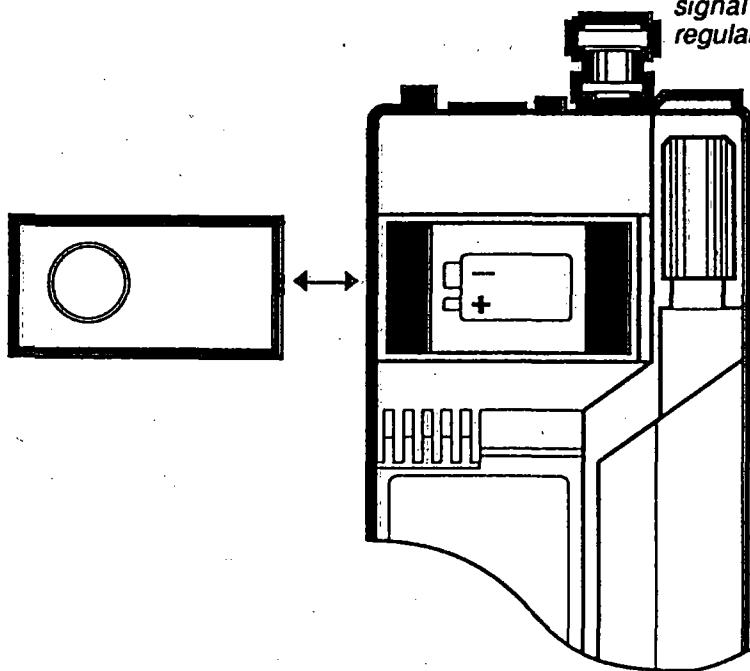


Figure 6

## Power Up and Checkout

1. Attach BNC Shorting Plug (Orion Cat. No. 090045) to BNC connector on top of meter.
2. Press power key to turn meter on.
3. If *battery* indicator remains on replace battery or use line adapter.
4. Press the POWER key to turn meter off.
5. Press the POWER key and *quickly* press the YES key to start the self-test. (Alternatively, press and hold the yes key while pressing the power key). The instrument automatically performs electronic and hardware diagnostic tests. See the explanation in the self-test section of the trouble shooting guide, page 47, for a more detailed explanation.
6. After code 7 a "0" will appear on the display. Press each key (the numeric digits will change).

*Note: All keys must be pressed within 10 seconds to complete test 7.*

- 7a. **Model 230A:** After the keypad test the meter will shut off.
- 7b. **Model 250A or Model 290A:** After the keypad test the meter will turn off then back on again. After completing the self-test the meter will resume normal operations
8. If any problems are found during self-test the meter will display the operator assistance code until acknowledged. Check the trouble-shooting section on page 47.

## Electrode Connections

(See Figure 7.)

### Orion Triode

Attach Orion TRIODE electrode by sliding the BNC connector onto the sensor input then push down and turn clockwise to lock into position. Slide the DIN connector into the ATC jack until it is firmly seated.

### Other Electrodes

Attach electrodes with BNC connectors to sensor input by sliding connector onto input, pushing down and turning clockwise to lock into position. Connect reference electrodes with pin tip connectors by pushing connector straight into reference input.

*Note: If using a combination electrode with a BNC connector the reference pin-tip is not used.*

### ATC Probe

Attach the ATC probe to the ATC jack by sliding the connector straight on until firmly in place. The connector has a special sealing mechanism to prevent moisture from penetrating the meter which is engaged when the connector is properly attached.

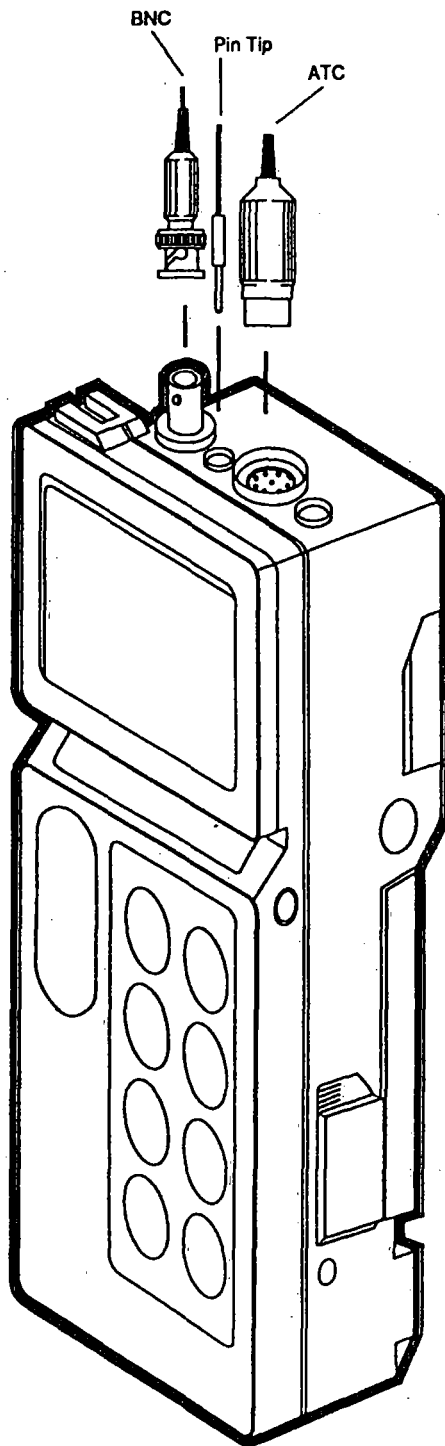
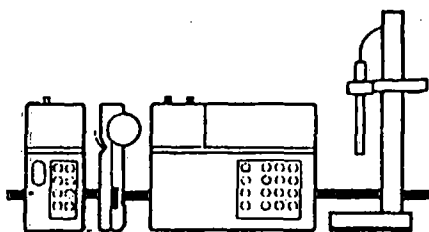


Figure 7



## Chapter V. Model 250A

### Display (Model 250A)

- |                          |   |                           |   |
|--------------------------|---|---------------------------|---|
| 1. <b>Operating Mode</b> | Indicates instrument operating mode.  | 5. <b>ATC</b>             | Displayed when a temperature probe is attached.   |
| <b>SETUP</b>             | <i>Indicates meter is in SETUP mode. Used to define operating parameters.</i>                           | 6. <b>2nd</b>             | Displayed when the 2nd key has been pressed, indicating the meter is ready to perform a secondary function.                                   |
| <b>CALIBRATE</b>         | <i>Indicates meter is in calibration mode, accessed by pressing 2nd then cal key.</i>                   | 7. <b>READY</b>           | Displayed when the electrode signal is stable. The READY function may be turned on or off in the SETUP menu.                                  |
| <b>MEASURE</b>           | <i>Indicates the meter is in measurement mode, accessed by pressing the measure key.</i>                | 8. <b>HOLD</b>            | Displayed when the pH reading is frozen after reaching stability in measure mode. The HOLD feature may be turned on or off in the SETUP menu. |
| 2. <b>Main Field</b>     | Displays pH, millivolts, or relative millivolts depending on the meter operating mode.                  | 9. <b>TIMER</b>           | Displayed when the timer function has been activated.   |
| 3. <b>ON/OFF</b>         | Indicates if a particular feature is active or not in the SETUP menu.                                   | 10. <b>BAT.</b>           | Displayed when the battery is low and needs to be replaced.   |
| 4. <b>Lower Field</b>    | Displays temperature in degrees Celsius. The °C designation is displayed when temperature is displayed. | 11. <b>Mode Indicator</b> | Designates instrument measurement mode either pH, millivolts (mV), or Relative millivolts (Rel mV).   |

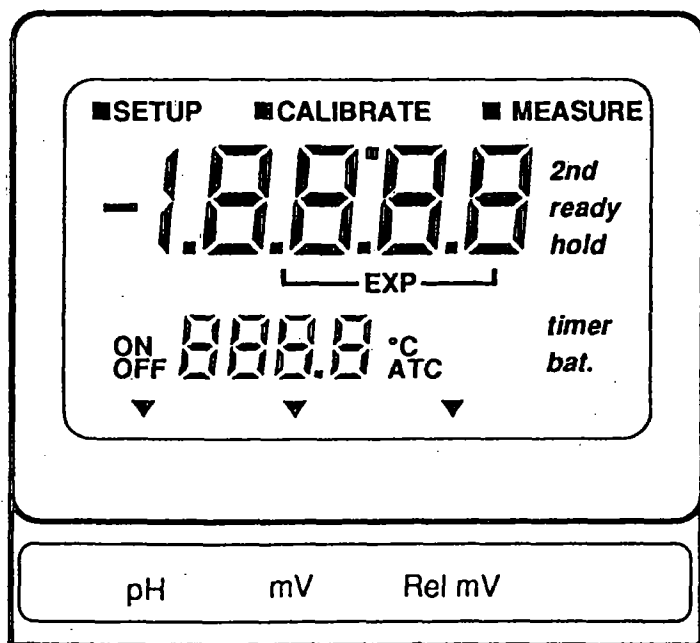


Figure 10

## Keypad (Model 250A)

(See Figure 11)

### Primary Functions

- yes** Press to enter a value during calibration or setup. May also be used to scroll through the setup menu without changing any parameters.
- no** Press to cancel a change to a parameter before entering.
- measure** Press for sample analysis. Instrument will remain in measure mode until another key is pressed. Press to unlock HOLD.
- mode** Press to change measurement modes. The options are pH, mV, or REL mV.
- 2nd** Press to access second functions, cal, timer, setup or print.
- Λ** Press to increase value.
- V** Press to decrease value.
- power** Press to turn meter on or off.

### Second Functions

All second functions are accessed by first pressing the 2nd key.

- cal** Press to start calibration. Meter automatically advances to MEASURE after the calibration is complete.
- timer** Press to start the timer. When the preset time has elapsed the instrument will beep for 1 minute (or until a key is pressed).
- print** Press to print display data.
- setup** Press to access the setup menu. This is used for setting instrument operating parameters.

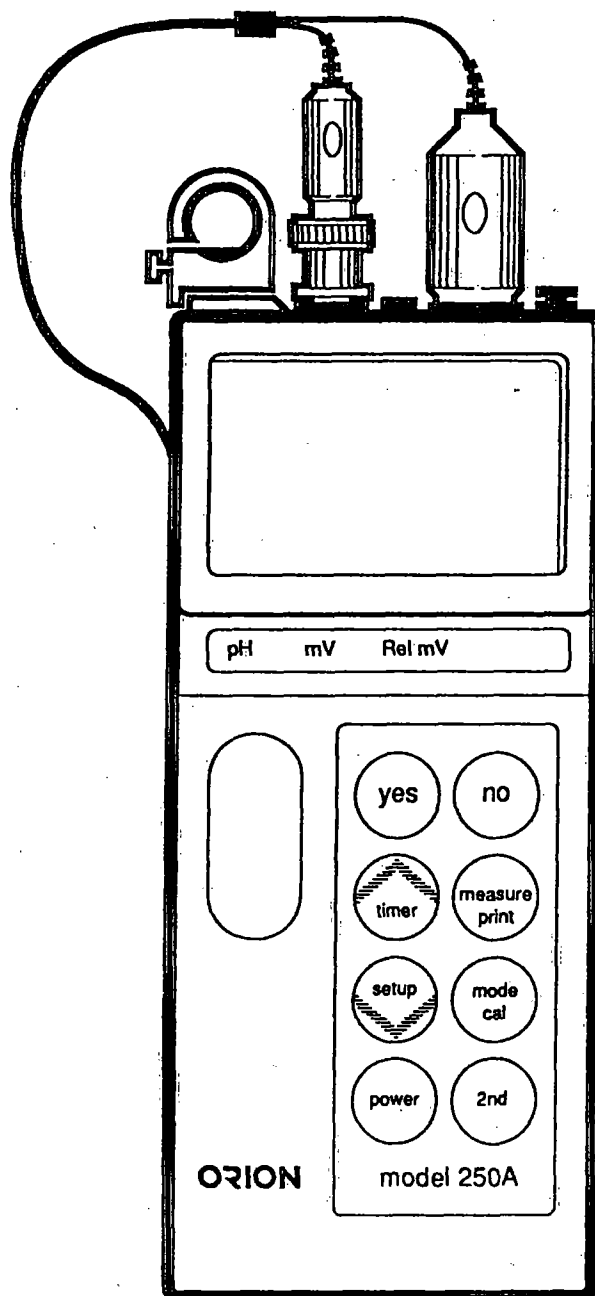


Figure 11

## Checkout Procedure (Model 250A)

1. Perform the self test as described on page 10.

*Note: To change a value press one of the ^ v keys. The first digit will flash, continue scrolling until the first digit equals the correct value then press YES. The second digit will flash. Scroll to the correct value then press YES. When all digits have been changed press YES to enter the new value.*

2. After the self-test the meter will be in MEASURE mode indicated by the legend MEASURE on the display.
  - a. Press the mode key until pH mode indicator is displayed. Main display should read a steady  $7.00 \pm 0.02$ . Press 2nd CAL and when the display flashes 7.00 press YES.
  - b. Press MEASURE. The main display should read 100.0 with the legend SLP in the lower display. If so, press YES. If not scroll until the display reads 100.0 then press YES.
  - c. The meter advances to MEASURE and the display should read a steady 7.00.
3. Press the mode key to enter millivolt mode.  $0.0 \pm .1$  should be displayed.
4. Press mode key to enter REL mV mode.  $0.0 \pm .1$  should be displayed. If not press 2nd cal then press YES to enter the value 0.0. Display should read a steady 0.0.
5. After steps 1 through 4 have been successfully completed the meter is ready for use with electrodes. Remove the shorting plug.

## SETUP Menu (Model 250A)

The setup menu is used to identify and change instrument operating parameters. In setup the yes key is used to scroll through the menu without changing any parameters. To change a parameter press one of the scroll keys, ^ v, then yes to enter. Pressing no reverts the parameter to its former state (if done before entering the new parameter).

To enter the setup menu press 2nd then setup. 1-1 and READY will be displayed. The on or off indicator flashes indicating the current status. Press yes to accept and continue through the menu. Press a scroll key, ^ v, to change. After changing a setting press yes to enter.

To change a numeric value press the ^ or v key, the first digit will start flashing. Scroll until the first digit is the desired value then press yes. The second digit will flash, scroll until the desired value is displayed then press yes. Continue in this manner until all digits have been changed to the desired value then press yes to enter the new value.

Scroll through the SETUP menu accepting or changing parameters as desired.

To exit the SETUP menu, press 2nd cal to begin the calibration sequence or measure to analyze samples.



The following parameters are accessed in the setup menu.

1-1	<b>READY</b>	Turning READY on will cause the ready indicator to be displayed when the electrode signal is stable. The default setting is on.	2-3	<b>ISO-POTENTIAL POINT</b>	Use to change the isopotential point for a particular pH electrode. In pH mode the default value is 7.00.
1-2	<b>HOLD</b>	Turning HOLD on will cause the display to freeze during sample measurements when the electrode signal is stable. Pressing measure unlocks hold and returns the meter to live displays during sample measurement. The default setting is off.	2-4	<b>RESET</b>	Sets all the calibration data and setup options to factory default values. This is particularly useful during trouble shooting or starting with a fresh electrode. To RESET press the $\Delta$ scroll key, the ON will flash and the beeper will ring rapidly. Press yes to reset. Press no to cancel.
1-3	<b>BEEP</b>	Turning BEEP on will cause an audible signal to sound on ready, when a key is pressed, and when an operator assistance code appears. The default setting is on.	3-1	<b>TIMER INTERVAL</b>	Used to set the timer interval. The maximum interval that can be set is 23 hours, 59 minutes, and 59 seconds. The minimum interval is five (5) seconds. When the <b>TIMER INTERVAL</b> code, 3-1, is displayed the current interval hours setting is displayed in the main field (H 00). Press YES to accept or scroll to change then press yes. Next the current interval minutes: seconds will be displayed (00:00). Press yes to accept current setting or scroll to desired value then press yes to enter. The default setting is five (5) seconds.
1-4	<b>AUTO-SHUTOFF</b>	Turning AUTO-SHUTOFF on will cause the meter to turn off if no keys have been pressed for 10 minutes. This feature will save battery life. The default setting is on.			
2-1	<b>SLOPE</b>	Allows review of electrode slope in memory at any time. The slope value cannot be changed in the setup menu.			
2-2	<b>RESOLUTION</b>	Allows selection of either 0.1 or 0.01 pH resolution. Press the scroll key to change the resolution, then press yes to enter and continue through the menu. The default setting is 0.01.	3-2	<b>TIME REMAINING</b>	Allows review of the time remaining before the <b>TIMER</b> is set to go off.

**3-3 SET REAL TIME**

Used to set the actual time of day. The meter uses a 24-hour clock. When the code 3-3 is displayed in the lower field, the current time (hours: minutes) is displayed in the main field. If correct press **yes** to accept otherwise change as required and press **yes** to enter the new time.

**3-4 SET DATE**

Used to set the current date. When the code 3-4 is displayed in the lower field, the current date (month:day) is displayed in the main field. Press **yes** to accept or change the date as needed then press **yes** to enter. Next the current year is displayed. Press **yes** to accept or change as required then press **yes** to enter.

**5-1 PRINT MODE**

Sets the print mode. When 5-1 is displayed in the lower field the current print mode is displayed in the main field. The options are:

- 1-Manual Print, indicates no automatic output to the printer and the user may print on command by pressing the print key;
- 2-Print on Ready, the meter will send information to the printer whenever the electrode signal reaches stability;
- 3-Print on a timed interval, printing occurs at a preset timed interval.

Use the scroll keys to change the setting, then press **yes** to enter the new setting. The default setting is 1; print on command.

**5-2 SET PRINT INTERVAL**

Used to set the timed print interval. The maximum print interval is 23 hours, 59 minutes and 59 seconds. The minimum print interval is 5 seconds. When the code 5-2 is displayed in the lower field, the current print interval hours will flash in the main display. Press **yes** to accept or change using the scroll keys, then press **yes** to enter. Next the print interval minutes:seconds will be displayed in the main field. Press **yes** to accept or change, then press **yes** to enter the new setting. The default setting is 1 minute.

*Note: Setup functions 2-1 Slope, 2-2 Resolution, and 2-3 Isopotential Point are only accessed in pH mode.*

## Calibration and Measurement Procedures (Model 250A)

### pH Measurements

A one or two buffer calibration should be performed before pH is measured. It is recommended that a two buffer calibration using buffers that bracket the expected sample range be performed at the beginning of each day to determine the slope of the electrode. This serves the dual purpose of determining if the electrode is working properly and storing the slope value in the memory. Perform a one buffer calibration every two hours to compensate for electrode drift.

Prior to calibration scroll through the SETUP menu and ensure all parameters are set properly for the analysis you want to perform. Select the resolution desired and verify the isopotential point is set correctly for the electrode.

There are two ways of calibrating the 250A Meter; autocalibration or manual calibration. Following are descriptions and instructions for each method.

#### Autocalibration

Autocalibration is a feature of the Model 250A Meter that automatically recognizes the buffers 7.00, 4.01, and 10.01 with a range of  $\pm 0.5$  pH units. During calibration the user waits for a stable pH reading. Once the electrode is stable, the meter automatically recognizes and displays the temperature-corrected value for that buffer. Pressing yes enters the value in memory.

*Note: Do not scroll when using autocalibration.*

The 250A Meter compares actual values to theoretical values to determine if the buffer is within range. Results greater than  $\pm 0.5$  pH units from the correct value will trigger an operator assistance code. For best results, it is recommended that an ATC probe be used. If an ATC probe is not used, all samples and buffers should be at the same temperature or use manual temperature compensation.

### Autocalibration with Two Buffers

1. Connect electrode(s) to meter. Choose either 4.01 and 7.00, or 7.00 and 10.01 buffers, whichever will bracket your expected sample range.
2. Press the mode key until the pH mode indicator is displayed.
3. Place electrode(s) into either 4.01, 7.00, or 10.01 buffer.
4. Press 2nd cal. CALIBRATION is displayed above the main field and the time and date of the last calibration are displayed. After a few seconds P1 is displayed in the lower field. P1 indicates that the meter is ready for the first buffer and a value has not yet been entered. When the electrode is stable, READY will be displayed and the temperature-corrected value for the buffer is displayed. Press yes. The display will remain frozen for two seconds, then P2 will be displayed in the lower field indicating the meter is ready for the second buffer.
5. Rinse electrodes and place in second buffer. Wait for a stable pH display and press yes.  
  
After the second buffer value has been entered the electrode slope will be displayed. SLP appears in the lower field with the actual electrode slope in percent in the main field.  
  
The meter automatically advances to the measure mode. MEASURE is displayed above the main field.
6. Rinse electrodes, place into sample. Record pH directly from the main meter display and temperature from the lower field.

### Autocalibration with One Buffer

1. Connect electrode(s) to meter. Select one buffer, either 4.01, 7.00, or 10.01, whichever most closely approximates the expected sample pH.
2. Press the **mode** key until the pH mode indicator is displayed.
3. Place electrodes into the buffer and press **2nd cal**. CALIBRATE will be displayed above the main field and the time and date of the last calibration will be displayed. After a few seconds P1 will be displayed in the lower field.
4. Wait for a stable reading (the display will flash) and press **yes**. The display remains frozen for two seconds then P2 is displayed in the lower field.
5. Press **measure**. SLP will be displayed in the lower field and the electrode slope in memory in the main field. If necessary enter the correct electrode slope determined by a two point calibration and press **yes**. If slope value is unknown enter 100.0 or perform a two buffer calibration.
6. Rinse electrodes and place into sample. Read the pH directly from the main display and temperature from the lower field.

### Manual Calibration

To calibrate with buffers other than 4.01, 7.00, or 10.01, use the manual calibration technique. The calibration sequence is the same as autocalibration except buffer values are manually entered using the scroll keys.

For best results it is recommended that an ATC probe be used. If an ATC probe is not used, all samples and standards should be at the same temperature or use manual temperature compensation. See page 43.

### Manual Calibration with Two Buffers

1. Connect electrode(s) to meter. Choose two buffers that will bracket your expected sample range.
2. Press the **mode** key until the pH mode indicator is displayed.
3. Place electrode(s) into the first buffer.
4. Press **2nd cal**. CALIBRATE will be displayed above the main readout and the time since the last calibration will be displayed. After a few seconds P1 will be displayed in the lower field.
5. Wait for a stable pH display then press the **^** or **v** key. The first digit will start flashing. Scroll until the correct value appears in the first digit, press **yes**. The second digit will start flashing. Scroll until the correct value appears in the second digit, press **yes**. Continue in this manner until all digits have been correctly entered.

The display remains frozen for two seconds then P2 is displayed in the lower field indicating the meter is ready for the second buffer.

6. Rinse electrode(s) and place into second buffer. Wait for a stable pH display then enter the correct value as described above.

The electrode slope is then displayed in the main field with SLP in the lower field. The meter automatically advances to MEASURE mode.

7. Rinse electrode(s) and place into sample. Record pH and temperature directly from the meter display.

## Manual Calibration with One Buffer

1. Connect electrode(s) to meter. Choose a buffer which most closely approximates the expected sample pH. Place electrode(s) into buffer.
2. Press the **mode** key until the pH mode indicator is displayed
3. Press **2nd cal**. CALIBRATE will be displayed above the main field and the time since the last calibration will be displayed. After a few seconds P1 will be displayed in the lower field.
4. Wait for a stable pH display then enter the correct buffer value.

To enter a value press the  $\Delta$  or  $\nabla$  key. The first digit will flash, continue pressing the scroll key until the desired value is displayed. Press **yes** to accept. Continue for each digit.

5. The P2 prompt will be displayed in the lower field. Press MEASURE.
6. The slope prompt, SLP, will now be displayed in the lower field and the electrode slope will be displayed in the main field. Press **yes** to enter the current electrode slope or scroll in a new value then press **yes**.

The meter automatically advances to measure mode.

7. Rinse electrode(s) and place into sample. Read sample pH directly from the meter display. Sample temperature is displayed in the lower field.

## Millivolt Measurements

The Model 250A Meter can be used to measure absolute or relative millivolts. The millivolt modes are useful when performing potentiometric titrations or preparing calibration curves. Detailed instructions for any ORION electrode are given in the electrode instruction manual. Titration instructions are included in the ORION Redox Electrode (Model 96-78 or 97-78) Instruction Manual, or in standard analytical chemistry texts.

### Absolute Millivolts

Absolute millivolts are displayed with 0.1 mV resolution in the range of -1600.0 to +1600.0 mV.

Access the absolute millivolt mode by pressing the **mode** key until the mV mode indicator is displayed.

### Relative Millivolts

Relative millivolts are displayed to 0.1 mV resolution over the range of -1999.9 to +1999.9 mV. (Absolute millivolt range  $\pm 1600.0$  mV)

1. Select the relative millivolt mode by pressing the **mode** Key until the Rel mV mode indicator is displayed.
2. Set the relative millivolt offset by pressing **2nd cal**. CALIBRATE will be displayed and the current absolute millivolts will be displayed in the main field.
3. Once the signal is stable the meter displays 0.0. Use the scroll keys to set the desired reading or leave the setting at 0.0. Press **yes** to enter. The meter automatically returns to MEASURE and all Relative millivolt measurements will be based on the offset.

## Dissolved Oxygen Measurements (Model 250A)

Dissolved oxygen measurements are displayed in ppm when the ORION Model 97-08 Dissolved Oxygen Electrode is used with the ORION Model 250A Meter. Follow these instructions for preparing the meter and calibrating the electrode.

1. Connect the Model 97-08 to meter and leave electrode mode switch "OFF".
2. Disconnect ATC probe.

*Note: ATC probe must not be connected to the meter.*

3. Press the mode key until the pH mode indicator is displayed.
4. Turn the hold feature (1-2) off.
5. Press measure. Using the scroll keys change the temperature value to 25.0°C.
6. Press 2nd cal. Enter the value 7.00 and press yes.
7. Press the measure key. The slope prompt, SLP, will be displayed in the lower field. Enter 100.0 and press yes.

The meter automatically enters the measure mode.

8. Turn the mode switch on the electrode to BT CK. Good battery operation is indicated by a reading of 13.40 or greater on the meter.
9. Turn the mode switch on the electrode to ZERO. Use the zero calibration control to set the meter to read 0.00.
10. Insert the reservoir (funnel) into a BOD bottle containing enough water to just cover the bottom. Insert the electrode, making sure that the electrode tip is not immersed in the water and does not have water droplets clinging to the outside of the membrane. Let stand approximately 30 minutes to ensure water saturation of air in the BOD bottle. This bottle should be used for storage between measurements.

11. Turn the electrode mode switch to the AIR position. If measurements are being made at sea level use the AIR calibration control on the electrode to set the pH meter reading to the prevailing barometric pressure in mm Hg(divided by 100). If the barometric pressure is unknown, if the elevation is above sea level or if the sample has a salinity greater than 2 parts per thousand, consult Table 1 found in the Model 97-08 Instruction Manual to obtain the correct AIR setting.
12. Turn the electrode mode switch to H<sub>2</sub>O for sample analysis

**OPERATION AND CALIBRATION INSTRUCTIONS  
FROM  
INSTRUCTION MANUAL FOR  
TURBIDITY METER  
MODEL 2008**

# SPECIFICATIONS & ACCESSORIES

<b>RANGE</b>	0-19.99 NTU 0-199.9 NTU
<b>ACCURACY</b>	± 2% of reading or 0.05 NTU, whichever is greater, referenced to LaMotte AMCO® standards
<b>DISPLAY</b>	0.5" LCD
<b>WARM-UP TIME</b>	<2 seconds
<b>PHOTODETECTOR</b>	Silicon photodiode, aligned 90° to the incident light path
<b>LAMP</b>	Tungsten, lens-end long life, operated at a color temperature of 2230° K
<b>SAMPLE</b>	Distance traversed by incident light and scattered light within tube is 2.5 cm
<b>LAMP LIFE</b>	45,000 hours
<b>RANGE SELECTOR</b>	4-position: Charge only, Off, 0-20 NTU, 0-200 NTU
<b>POWER SOURCE</b>	Ni-Cad rechargeable batteries, not user replaceable
<b>SIZE</b>	19 cm x 7 cm x 14 cm 7.5" x 2¾" x 5½"
<b>WEIGHT</b>	1.1 Kg 2.4 lbs.

## REPLACEMENT PARTS & ACCESSORIES

5115PT-J	Deionized Water, 100 mL
1793	AMCO® Turbidity Standard, 0.5 NTU
1794	AMCO® Turbidity Standard, 5.0 NTU
1795	AMCO® Turbidity Standard, 20.0 NTU
1796	AMCO® Turbidity Standard, 60.0 NTU
1797	AMCO® Turbidity Standard, 100.0 NTU
1798	AMCO® Turbidity Standard, 40.0 NTU
1744	AC Adapter, 9 Volt
0273	Turbidity tubes, set of 6
0943	Syringe
0598	Fiber holder
1103-6	Membrane filters, 0.45 micron, pkg of 6

# CALIBRATING

The Model 2008 has been calibrated at the factory using a primary standard manufactured by Advanced Polymer Systems, Inc., which is a suspension of uniformly sized plastic "microspheres." These AMCO® standards require no preparation, and are stable for longer periods of time than formazin. However, with proper preparation techniques, formazin standards should be equivalent to the AMCO® standards, and can be used as primary standards for meter calibration. For proper procedures, consult the current edition of *Standard Methods for the Examination of Water and Wastewater*.

## AMCO® TURBIDITY STANDARDS

Two AMCO® turbidity standards are supplied with the Model 2008; additional standards are available from LaMotte Company. Only use LaMotte AMCO® standards with the Model 2008. These standards are manufactured exclusively for LaMotte and are guaranteed to be accurate to within ± 1%, if the following procedures are observed:

1. Once the seal on the bottle is broken, the standard is good for 9 months, and must be stored between 10° and 40° C. The standards are good indefinitely prior to opening if stored under the same conditions.
2. Never put any unused standard or other possible contaminant into the bottle.
3. Do not open the standards in a dusty environment, and guard against dust and other contaminants entering the bottle while opened.
4. Rinse sample tube with standard before filling with standard to be used.
5. Cap the sample tube and standard bottle immediately after filling tube with standard.



## **TURBIDITY TUBES**

To assure accurate readings the tubes supplied with the Model 2008 should be paired with marked caps. Mark each cap with a piece of tape, and pair with a tube. When the tubes are inserted into the chamber, the tape should always be oriented the same way, for instance, the tape should always point toward the operator. If greater accuracy is required, for instance for Surface Water requirements, the tubes supplied with the Model 2008 should be calibrated. Fill all the tubes with the same turbidity standard, preferably one at the higher end of the testing range. Insert each tube into the meter, and record the reading. This data will indicate the correction factor which should be used when comparing results in different tubes.

## **THE MODEL 2008 TURBIDIMETER**

1. Select the AMCO® standard closest to the value of the sample.

**NOTE:** Only use LaMotte specific AMCO® turbidity standards with the Model 2008. Contact LaMotte for replacement standards.

2. Switch the selection knob to the proper range (0 - 20 or 0 - 200 NTU).

3. Fill turbidity tube with standard. Cap with paired, marked cap. Wipe tube with a lint-free tissue.

4. Insert tube into chamber. Cap chamber.

**NOTE:** The green LED will light to indicate tube is fully inserted, and the meter is working.

5. Adjust STANDARDIZE knob until display reads value of standard. The Model 2008 is now calibrated and ready for use.

1. Fill a clean container with at least 50 mL of sample water. Set container aside to allow sample to equilibrate to air temperature, and to let gasses escape.

**NOTE:** Do not let dust or other airborne contaminants contact sample.

2. Rinse an empty turbidity tube with sample. Fill turbidity tube to neck with sample water.

**NOTE:** Pour sample down the side of tube to avoid creating air bubbles.

3. Cap with paired, marked cap. Wipe tube with a lint free tissue.

4. Insert tube into chamber. Cap chamber. Select appropriate range on selection knob. As soon as reading stabilizes, record reading as NTU.

**NOTE:** The green LED will light to indicate tube is fully inserted, and the meter is working.

5. If the sample has a turbidity reading of greater than 200 NTU, the sample must be diluted with turbidity-free water before being tested. Multiply result by the appropriate factor.

**ATTACHMENT 2**

**STANDARD OPERATING PROCEDURE (SOP)  
FOR METHANE IN SOIL GAS**

**Standard Operating Procedure for the  
Field Measurement of Soil Emissions of Methane Gas**

**I. PARAMETERS**

Methane ( $\text{CH}_4$ ), as a percentage of soil-gas.

**II. RANGE OF MEASUREMENT**

$\text{CH}_4$ : 0 - 100% of soil-gas sample.

**III. LIMIT OF DETECTION**

$\text{CH}_4$ : 1 % of sample.

**IV. SAMPLE MATRIX**

Soil-gases.

**V. PRINCIPLE, SCOPE, AND APPLICATION**

An infrared beam is projected through the gas sample. On the other side of the chamber the beam is sensed by Methane and carbon dioxide detectors. A microprocessor calculates the amount of infrared light absorbed at different wavelengths and determines the Methane concentration. The instrument is factory-calibrated to Methane and displays percentage of Methane.

**VI. INTERFERENCES AND CORRECTIVE ACTION**

If water were to be drawn through the gas analyzer unit, the unit would be contaminated and a water trap has been attached as a preventive measure. Contaminated units are sent in for service.

**VII. SAFETY PRECAUTIONS**

The instrument will be powered by its own ni-cad battery pack, charged with its own AC charger. No substitutions will be made.

Neither the gas analyzer nor any personnel will enter any confined spaces.

**VIII. SAMPLE SIZE, COLLECTION, PRESERVATION, AND HANDLING**

Every four hours during a 24-hour period, one member of the two-member sampling team connects a GA-90 Analyzer's sample intake tubing to a shallow ground probe

(a copper tube inserted 18 inches into the ground and capped with a Polyethylene twistcock). Methane readings are taken and recorded immediately.

#### **IX. APPARATUS AND MATERIALS**

GA-90 Analyzer  
Battery charger  
Tygon tubing  
24 inch long, ½ inch i.d. shallow ground probe  
Rubber stopper  
Polyethylene twistcock

#### **X. ROUTINE PREVENTIVE MAINTENANCE**

Only trained and authorized LANDTEC personnel should attempt any maintenance or repairs.

Battery pack charging should be done when meter indicates Low Battery.

#### **XI. REAGENTS AND CALIBRATION STANDARDS**

The instrument is factory calibrated for Methane immediately prior to use in the field.

#### **XII. CALIBRATION PROCEDURES**

Initial start-up and zero set:

1. Press KEY 1-CH<sub>4</sub> Calibration on the Calibration Screen to bring up the Methane Calibration Screen.
2. Press KEY 1-Zero CH<sub>4</sub> to bring up the Zero Methane Screen.
3. Press KEY 5-Pump. This turns on the sample pump. The unit should be drawing ambient air (free of Methane). Run pump for five minutes.
4. Press KEY 1-Zero level and either "CH<sub>4</sub> Not Zeroed" or "CH<sub>4</sub> Zeroed" will be displayed before returning to the Zero Methane Screen.
5. If "CH<sub>4</sub> Not Zeroed" is displayed, return the Gas Calibration Screen by pressing KEY 0-Exit and recheck that no Methane is present. Re-zero for Methane.
6. If "CH<sub>4</sub> Zeroed" is displayed, press KEY 0-Exit to return to the Methane Calibration Screen and begin sampling.

**XIII. SAMPLE PREPARATION**

Not applicable. Analysis is done directly on soil-gas emissions collected in shallow ground probe.

**XIV. ANALYTICAL MEASUREMENT**

1. Turn on pump.
2. Attach sampling hose to twistcock on shallow ground probe.
3. Open twistcock and allow pump to evacuate shallow ground probe.
4. Record highest Methane percentage reading on Methane Data Sheet.
5. Close twistcock.
6. Remove hose from twistcock and proceed to next sampling location.

**XV. FLOW CHART**

Not applicable.

**XVI. DATA TREATMENT**

Record results on the Methane Data Sheet.

Actual recorded results will be provided along with Estimated Annual Methane Generation Rates derived from the data recorded on the Methane Data Sheet.

**XVIII. QUALITY CONTROL**

Not applicable as measurements are real time direct read-outs. An upwind off-site location will be measured before field work each day to determine background conditions.

**IXX. REFERENCES**

1. GA-90 Operation Manual, Version MK2B 1.02, 1994.
2. HAZCO Customer Service 1 (800) 332-0435.

**XX. METHOD VALIDATION DATA**

1. Not applicable when CH<sub>4</sub> is being measured only to verify presence and estimate annual generation.
2. With respect to data to be used for calculating annual Methane production, these results are validated through baseline measurements referencing various traceable gas mixtures in an environmental chamber.

**ATTACHMENT 3**

**USACE ENVIRONMENTAL REGULATION  
NO. 1110-1-263 (1 OCTOBER 1990)**

APPENDIX F  
SAMPLE HANDLING PROTOCOL  
FOR  
LOW, MEDIUM AND HIGH CONCENTRATION SAMPLES  
OF  
HAZARDOUS WASTE

1. Purpose. This protocol provides guidance on sample volumes, containers, packing, and shipping for low, medium, and high concentration environmental samples taken for chemical analysis.

2. Applicability. The guidance in this appendix applies to all samples taken by USACE for HTW chemical analysis. The requirements are consistent with those of the Environmental Protection Agency and all standard chemical methods generally used are included.

3. Low Concentration Samples. Low level samples are considered to be those collected off-site, around the perimeter of a waste site, or in areas where hazards are thought to be significantly reduced by normal environmental processes.

a. Waters.

(1) Organics.

(a) Bottle and Preservative Requirements.

- o Four 1-liter amber glass bottles (Teflon-lined caps), iced to 4°C (may not be held at site over 24 hours). Remember: Leave some headspace!
- o Two 40 mL glass VOA vials (with Teflon septa), iced to 4°C (may not be held at site over 24 hours). Fill completely! All air bubbles must be excluded. Add HCl (4 drops of concentrated HCl) or NaHSO<sub>4</sub> to pH < 2.
- o The samples above are needed when Method 8240 is used to analyze for volatile (or purgeable) organics, when Methods 8250 or 8270 are used to analyze for Base/Neutral/Acid (B/N/A) extractable organics, and when Method 8080 is used to analyze for pesticides and PCB's. Two of the 1-L bottles are needed for 8250 or 8270 and two for 8080.



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- o Oil and Grease, Total Organic Carbon (TOC) or TRPH. For each analyte, two 1-liter glass bottle (Teflon-lined cap), 5 mL 1:1 HCl (to pH < 2), and 4°C. Leave headspace.

(b) Paperwork/Labels.

- o (ENG Form 5021-R) Chain of Custody Record. See attached example. It is important to note that only one site may be listed per form even if the sites have the same project number. Top original goes with the samples; a copy should be saved for the sampler's files.
- o Receipt for Samples. See attached example. This form complies with the requirements that the owner, operator, or agent-in-charge is legally entitled to: (1) a receipt describing the samples obtained from the site and; (2) a portion of each sample equal in weight or volume to the portion retained, if requested. The original form is retained for the Project Coordinator and a copy is given to the owner, operator, or agent-in-charge.
- o Sample Labels/Tags. See attached example. You must label the sample with a date, time of collection, site name, and brief description on a label that will not float/soak off - no masking tape, please. Use only indelible ink on all labels. Numbered sample labels should be used on all samples. Some projects may also require the use of sample tags in addition to labels.

(c) Packaging and Shipping.

- o Waterproof metal (or equivalent strength plastic) ice chests or coolers only.
- o After filling out the pertinent information on the sample label and tag, put the sample in the bottle or vial and screw on the lid. For bottles other than VOA vials, secure the lid with strapping tape. (Tape on VOA vials may cause contamination.) Then, secure the string from the numbered approved tag around the lid.
- o Mark volume level on bottle with grease pencil.

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- o Place about 3 inches of inert cushioning material such as vermiculite in the bottom of the cooler.
- o Enclose the bottles in clear plastic bags through which sample tags and labels are visible, and seal the bag. Place bottles upright in the cooler in such a way that they do not touch and will not touch during shipment.
- o Put in additional inert packing material to partially cover sample bottles (more than halfway). Place bags of ice around, among, and on top of the sample bottles. If chemical ice is used, it should be placed in a plastic bag.
- o Fill cooler with cushioning material.
- o Put paperwork (chain of custody record) in a waterproof plastic bag and tape it with masking tape to the inside lid of the cooler.
- o Tape the drain shut.
- o Secure lid by taping. Wrap the cooler completely with strapping tape at a minimum of two locations. Do not cover any labels.
- o Attach completed shipping label to top of the cooler.
- o Put "This Side Up" labels on all four sides and "Fragile" labels on at least two sides.
- o Affix numbered and signed custody seals on front right and back left of cooler. Cover seals with wide, clear tape.

Remember that each cooler cannot exceed the weight limit set by the shipper.

(2) Inorganics.

(a) Bottle and Preservative Requirements.

- o Metals. One 1-liter high density polyethylene bottle (Teflon-lined cap), adjust to pH < 2 with 1:1 HNO<sub>3</sub> (usually 3 mL).

- o Cyanides. One 1-liter high density polyethylene bottle (Teflon-lined cap), adjust to pH > 12 with NaOH (usually 2 mL of 10N NaOH or 4 pellets), and 4°C.
- o Sulfide. One 1-liter high density polyethylene bottle (Teflon-lined cap), 4 mL 2.0 N zinc acetate and adjust pH > 9 with NaOH, and 4°C.
- o Fluoride. One 1-liter high density polyethylene bottle (Teflon-lined cap), no preservative, and 4°C.
- o pH. No preservative. Must be measured twice immediately in field. Do not ship.
- o Ammonia, Total Kjeldahl Nitrogen, Nitrate/Nitrite. For each analyte, one 1-liter high density polyethylene bottle (Teflon-lined cap), adjust to pH < 2 with H<sub>2</sub>SO<sub>4</sub> (usually 4 mL 1:1 H<sub>2</sub>SO<sub>4</sub>), and 4°C.

(b) Paperwork/Labels.

- o Inorganic Paperwork is the same as described for organics (see Section 3.a.(1).(b). above) and includes the Chain of Custody Record, Receipt for Samples, and Labels/Sample Tags. See previous examples and explanations.

(c) Packaging and Shipment.

- o Follow packaging and shipping requirements listed for organics (see Section 3.a.(1).(c). above). "Fragile" labels are optional for coolers not containing glass bottles. In cases where ice is not required (metals), fill cooler with only packing material. Once again, remember that the cooler must not exceed the shipper's weight limit.

b. Soils/Sediments (Organics and Inorganics).

(1) Bottle and Preservative Requirements.

- o Two 8-ounce glass wide mouth jars at least 3/4 full (Teflon-lined caps), iced to 4°C - one jar for organics (non-VOA) and one jar for inorganics. For analysis of volatiles in soil, two 40 mL VOA vials or two 125 mL jars with Teflon septa are used. These should be completely filled and iced to 4°C.

(2) Paperwork/Labels.

- o Follow paperwork requirements listed for water samples in Section 3.a.(1).(b). above. See attached examples of forms.

(3) Packaging and Shipping.

- o Follow packaging and shipping requirements in Section 3.a.(1).(c). above. Be sure that the shipping cooler does not exceed the shipper's weight limits.

4. Medium Concentration Samples. Medium level samples are most often those collected on-site, in areas of moderate dilution by normal environmental processes.

a. Water/Liquids (Organics and Inorganics).

Note: Samples are not known to contain highly toxic compounds.

(1) Bottle and Preservative Requirements.

- o Four 32-ounce wide mouth glass jars (Teflon-lined caps), no preservatives, and iced to 4°C for B/N/A extractable organics and PCB/Pesticides (two jars for each method). Remember: Leave some headspace.
- o Two 40 mL glass VOA vials (Teflon septa), Iced to 4°C. Fill completely. No headspace.
- o Two 16-ounce wide mouth glass jars nearly full (Teflon-lined caps) one for metals and one for cyanides. (Preserved as for low level. See Section 3.a.(2).(a).)

(2) Paperwork/Labels.

- o See previous examples. Follow paperwork requirements in Section 3.a.(1).(b). for low concentration samples.

(3) Packaging and Shipping

- o Secure sample jar lids with strapping tape or evidence tape. At the same time secure string from USEPA numbered tag around lid.

- o Mark volume level of bottle with grease pencil.
- o Position jar in Ziploc bag so that tags may be read.
- o Place about 1/2 inch of cushioning material in the bottom of metal can.
- o Place jar in can and fill remaining volume of can with cushioning material.
- o Close the can using three clips to secure lid.
- o Write sample number on can lid. Indicate "This Side Up" by drawing an arrow and place "Flammable Liquid N.O.S." label on can. Personnel who ship samples must be sure to comply with DOT shipping regulations and not knowingly over-classify a sample prior to shipment. If the person shipping a sample knows that the sample is not a "Flammable Liquid" (i.e., a water phase sample or a soil sample), he should not classify it as "Flammable Liquid."
- o Place about 1 inch of packing material in bottom of cooler.
- o Place cans in cooler and fill remaining volume of cooler with packing material. Add ice bags if required.
- o Put paperwork in plastic bags and tape with masking tape to inside lid of cooler.
- o Tape drain shut.
- o After acceptance by shipper, tape cooler completely around with strapping tape at two locations. Secure lid by taping. Do not cover any labels.
- o Place lab address on top of cooler.

**Note:** Write "Flammable Liquid N.O.S." on side of cooler if this is not marked on the margin of your DOT label.

- o For all medium and high concentration shipments, complete shipper's hazardous material certification form.

- o Put "This Side Up" labels on all four sides sides, "Flammable Liquid N.O.S." and "Danger-Peligro" on all sides.

**Note:** "Danger-Peligro" labels should be used only when net quantity of samples in cooler exceeds 1 quart (32 ounces) for liquids or 25 pounds for solids. In other words, for our purposes "Danger-Peligro" labels will never be used for Flammable Solids N.O.S.

- o Affix number custody seals on front right and back left of cooler. Cover seals with wide, clear tape.

b. Soils/Sediments/Solids (Organics and Inorganics).

(1) Bottles and Preservatives Requirements.

- o For analysis of volatiles, two 40 mL VOA vials or two 125 mL jars with Teflon septa are used. These should be completely filled and iced to 4 °C.
- o Two 8-ounce wide mouth glass jars, 3/4 full (Teflon-lined caps), no preservatives, one jar for organics (non-VOA) and one jar for inorganics (metals and cyanide) or
- o Four 4-ounce wide mouth glass jars each 3/4 full (Teflon-lined caps), no preservative; two jars for organics (non-VOA) and two jars for inorganics.

(2) Paperwork/Labels.

- o See previous examples. Follow paperwork requirements listed in Section 3.a.(1).(b). for low concentration samples.

(3) Packaging and Shipping.

- o Follow packaging and shipping requirements listed in Section 3.a.(1).(c). for medium concentration water/liquids above substituting "Flammable Liquid N.O.S." with "Flammable Solid N.O.S."

5. High Concentration Samples (Hazardous: Determined Not to be D.O.T.-Defined Poison A). High concentration samples include those from drums, surface impoundments, direct discharges, and chemical spills, where there is little or no evidence of environmental dilution. High concentration (or high

hazard) samples are suspected to contain greater than 15% concentration of any individual chemical substituent.

a. Liquids (Organics and Inorganics).

(1) Bottle and Preservative Requirements.

- o One 8-ounce wide mouth glass jar filled 1/2 to 3/4 full (Teflon-lined cap). No preservative.

(2) Paperwork/Labels.

(a) See previous examples. Follow paperwork requirements listed in Section 3.a.(1).(b). above.

(b) Shipper may require special forms to be completed before shipment of high hazard concentration samples.

(3) Packaging and Shipping.

- o Follow packaging and shipping requirements listed in Section 3.a.(1).(c). above for medium concentration water/liquids.

b. Soils/Sediments/Solids (Organics and Inorganics).

(1) Bottle and Preservative Requirements.

- o One 8-ounce wide-mouth glass jar filled 1/2 to 3/4 full (Teflon-lined cap). No preservative.

(2) Paperwork/Labels.

- o See attached examples. Follow paperwork requirements in Section 3.a.(1).(b). above.

(3) Packaging and Shipping.

- o Follow packaging and shipping requirements listed in Section 3.a.(1).(c). for medium concentration water/liquids, substituting "Flammable Liquid N.O.S." with "Flammable Solid N.O.S."

TABLE F-1

SAMPLE CONTAINERS, PRESERVATIVES, AND HOLDING TIMES

<u>Low Concentration Samples</u>				<u>Maximum Holding Times:</u>	
<u>Matrix</u>	<u>Parameter</u> <sup>1</sup>	<u>Container</u> <sup>2</sup>	<u>Preservation</u> <sup>3</sup>	<u>Extraction</u> <sup>4</sup>	<u>Analysis</u>
Water	Volatiles	2 x 40 mL <sup>8</sup> G, Septa vial	Ice to 4°C 4 drops con HCl or NaHSO <sub>4</sub> to pH<2	-	14 d
Water	B/N/A	2 x 1 L <sup>5,8</sup> amber G	Ice to 4°C	7 d	40 d
Water	PCBs, Pesticides	2 x 1 L <sup>5,8</sup> amber G	Ice to 4°C	7 d	40 d
Water	Metals <sup>6</sup>	1 x 1 L P	HNO <sub>3</sub> to pH<2	-	6 mo <sup>6</sup>
Water	TRPH	2 x 1 L G	Ice to 4°C HCl to pH<2	-	28 d
Water	Common <sup>7</sup> anions	1 x 1 L <sup>7</sup> G	Ice to 4°C	-	28 d <sup>7</sup>
Water	Explosives	2 x 1 L G (amber)	Ice to 4°C	7 d	40 d
Water	Cyanide	1 x 1 L P	NaOH to pH>12 Ice to 4°C	-	14 d
Soils/ Sed.	Volatiles	2 x 40 mL G or 2 x 125 mL G, Septa vial	Ice to 4°C	-	14 d
Soils/ Sed.	B/N/A, PCBs, Pesticides	1 x 8 oz G	Ice to 4°C	14 d	40 d
Soils/ Sed.	Metals, Cyanide, TRPH	1 x 8 oz G	Ice to 4°C (Cyanide & TRPH)	-	6 mo <sup>6</sup> (TRPH: 28d)
Soils/ Sed.	Explosives	1 x 4 oz G	Ice to 4°C	14 d	40 d



TABLE F-2

SAMPLE CONTAINERS AND PRESERVATIVES<sup>9</sup>

<u>Medium Concentration Samples</u>			
<u>Matrix</u>	<u>Parameter</u> <sup>1</sup>	<u>Container</u> <sup>2</sup>	<u>Preservation</u> <sup>3</sup>
Water/Liquid	Volatiles	2 x 40 mL G, Septa vial	Ice to 4°C <sup>8</sup>
Water/Liquid	B/N/A <sup>5</sup>	2 x 32 oz wide mouth jars, G	Ice to 4°C <sup>8</sup>
Water/Liquid	PCBs <sup>5</sup> , Pesticides	2 x 32 oz wide mouth jars, G	Ice to 4°C <sup>8</sup>
Water/Liquid	Metals	1 x 16 oz wide mouth jar, G	HNO <sub>3</sub> to pH<2
Water/Liquid	Cyanide	1 x 16 oz wide mouth jar, G	Ice to 4°C
Water/Liquid	Explosives	2 x 1 L G (Amber)	Ice to 4°C
Soils/ Sediments	Volatiles	2 x 40 mL G or 2 x 125 mL G	Ice to 4°C
Soils/ Sediments	B/N/A, PCBs, Pesticides	1 x 8 oz wide mouth jar, G	---
Soils/ Sediments	Metals, Cyanide, TRPH	1 x 8 oz wide mouth jar, G	Ice to 4°C (Cyanide & TRPH)
Soils/ Sediments	Explosives	1 x 4 oz wide mouth jar, G	Ice to 4°C

High Concentration Samples

<u>Matrix</u>	<u>Parameter</u> <sup>1</sup>	<u>Container</u> <sup>2</sup>	<u>Preservation</u>
Liquid	All organic and inorganic analyses	1 x 8 oz wide mouth jar, G	---
Solid	All organic and inorganic analyses	1 x 8 oz wide mouth jar, G	---

1. B/N/A = Base/Neutral/Acid extractables; TRPH = Total Recoverable Petroleum Hydrocarbons
2. All containers must have Teflon-lined seals (Teflon-lined septa for VOA vials). G = Glass; P = High density polyethylene.
3. Sample preservation will be done in the field immediately upon sample collection. If water samples are filtered in the field, differential pressure methods using 45 micron filters will be used, and preservative added after filtration. VOA samples should never be filtered.
4. When only one holding time is given, it implies total holding time from sampling until analysis.
5. Three bottles are required on at least 5-10% (but at least one) sample so that laboratory can perform all method QC checks for SW-846 method.
6. Total Recoverable Metals for water samples. Holding time for Hg is 28 days in glass; for Cr(VI) is 24 hours.
7.  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{F}^-$ ,  $\text{NO}_3^-$ ,  $\text{NO}_2^-$ ,  $\text{PO}_4^{3-}$ ,  $\text{SO}_4^{2-}$ ; 1 L for each method; orthophosphate requires filtration. Holding time for extraction is 48 hours for  $\text{NO}_2^-$ ,  $\text{NO}_3^-$ , and  $\text{PO}_4^{3-}$  if not preserved with  $\text{H}_2\text{SO}_4$  to  $\text{pH} < 2$ .
8. Samples with residual chlorine present will be dechlorinated with sodium thiosulfate as specified in SW-846 (Third edition).
9. Holding times for medium concentration samples are the same as those specified for low concentration samples.

# U.S. Army Corps of Engineers

## Chain of Custody Record (ER 1110-1-263)

ER 1110-1-263  
1 Oct 90

Proj. No.		Project Name				Number of Containers											Remarks:
Sampler: (Signature)																	
Date	Time	Pres.	Grab	Comp	Site Code/Sample Number												
<b>FOR ILLUSTRATION PURPOSES ONLY</b> (Local reproduction authorized - blank masters available from local FMO)																	
Sampler Relinquished by:		Date/Time		Received by: (Sig.)				Date/Time		Hazards Associated with Samples							
Relinquished by: (Sig.)		Date/Time		Received by: (Sig.)				Date/Time									
Relinquished by: (Sig.)		Date/Time		Received for Laboratory by: (Sig.)				Date/Time		Remarks at time of receipt:							
Custody Seal No.				Lab case No.:													

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**SAMPLE**

U.S. Army Corps of Engineers

Chain of Custody Record  
(ER 1110-1-263)

Proj. No. <b>017</b>		Project Name <b>ANY ARMY AMMUNITION PLANT</b>			Number of Containers	<div style="display: flex; justify-content: space-around;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">Volatile Organics</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">B/N/A</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">TOTAL METALS</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">TRPH</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">EXPLOSIVES</div> </div>					Remarks:
Sampler: (Signature) <i>Marcin Chaves</i>											
Date	Time	Pres.	ANALYSIS	Site Code/Sample Number							
9/4	0930	4°C	X	AAAP-SB01-0001	2	X					Strong hydrocarbon odor
9/4	0935	4°C	X	AAAP-SB01-0001	1		X	X		X	" " "
9/4	0937	4°C	X	AAAP-SB01-0001	1				X		" " "
9/4	1035	$\text{PH} \approx 2$ $\text{HNO}_3$ 4°C	X	AAAP-MW02-0001	2	X					No visual turbidity
9/4	1036	4°C	X	AAAP-MW02-0001	2		X				" " "
9/4	1040	$\text{PH} \approx 2$ $\text{HNO}_3$ 4°C	X	AAAP-MW02-0001	1			X			" " "
9/4	1050	$\text{PH} \approx 2$ $\text{HNO}_3$ 4°C	X	AAAP-MW02-0001	2				X		" " "
9/4	1055	4°C	X	AAAP-MW02-0001	1					X	" " "
Sample Relinquished by: <i>Marcin Chaves</i>					Date/Time: 9/4/1400	Received by: (Sig.)		Date/Time:		Hazards Associated with Samples <b>NONE</b>	
Relinquished by: (Sig.)					Date/Time:	Received by: (Sig.)		Date/Time:		Remarks at time of receipt:	
Relinquished by: (Sig.)					Date/Time:	Received for Laboratory by: (Sig.)		Date/Time:			
Custody Seal No. <b>1535</b>					Lab case No.:						

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ER 1110-1-263  
1 Oct 90

ER 1110-1-263  
1 Oct 90

### SAMPLE LABELS

SITE NAME	DATE
ANALYSIS	TIME
	PRESERVATIVE

Lot # 9052023

SPECIALTY CLEANED CONTAINER

SITE NAME	DATE
Atlas Missile Site	6/1/89
ANALYSIS	TIME
Total Metals	1200
Sampler <i>→</i> KC	PRESERVATIVE
	HNO3

Lot # 9052023

SPECIALTY CLEANED CONTAINER

### SAMPLE TAGS

Proj. Code	Station No.	Month	Day	Year	Time	Designate.	Comp.	Grab	Samplers (Signatures)	Preservative:	
										Yes <input type="checkbox"/> or No <input type="checkbox"/>	
Station Location										ANALYSES	
										BOD	Anions
Station Location										Solids (TSS) (TDS) (SS)	
										COD, TOC, Nutrients	
Station Location										Phenolics	
										Mercury	
Station Location										Metals	
										Cyanide	
Station Location										Oil and Grease	
										Organics GC/MS	
Station Location										Priority Pollutants	
										Volatile Organics	
Station Location										Pesticides	
										Mutagenicity	
Station Location										Bacteriology	
										Remarks:	
Tag No.										Lab Sample No.	

Proj. Code	Station No.	Month	Day	Year	Time	Designate.	Comp.	Grab	Samplers (Signatures)	Preservative:	
										Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
Station Location										ANALYSES	
										BOD	Anions
Station Location										Solids (TSS) (TDS) (SS)	
										COD, TOC, Nutrients	
Station Location										Phenolics	
										Mercury	
Station Location										Metals	
										Cyanide	
Station Location										Oil and Grease	
										Organics GC/MS	
Station Location										Priority Pollutants	X
										Volatile Organics	
Station Location										Pesticides	X
										Mutagenicity	
Station Location										Bacteriology	
										Remarks: CASE 1746	
Station Location										ITR # ME0637	
										Bottle Lot # 63129	
Tag No.										Lab Sample No.	
10502											

APPENDIX G

GLOSSARY

1. **Chemical Contamination Activities** - All activities related to the cleanup of chemical contamination at a site including investigation and remedial activities. This definition includes activities defined by EPA as "removal activities" and "remedial activities".
2. **Chemical Data Acquisition Plan (CDAP)** - A submittal document which describes the site specific implementation of CDQM requirements. For investigation and design contracts, CDQM guidance and requirements for CDAP preparation and implementation are found in the Scope of Services. For construction contracts, these requirements are found in the contract technical specifications in language which is clearly biddable and enforceable. The CDAP shall include detailed plans for sampling, analysis, and chemical QC activities. A guide for preparation of the CDAP is found in Appendix D. A CDAP is required for both in-house and contracted work. The EPA equivalent is called a Quality Assurance Project Plan (QAP<sub>j</sub>P) and may be substituted for the CDAP.
3. **Chemical Data Quality Management (CDQM)** - The combination of activities establishing a government quality assurance (QA) program and specifying quality control (QC) operations for the AE, construction contractor, or USACE District. CDQM includes the maintenance of field and laboratory practices/checks which insure that Data Quality Objectives (DQO) are met.
4. **Chemical Data Management Specifications** - Construction Contract technical specifications prepared during design which describe all construction contractor sampling, sample handling and custody, documentation, analytical procedures, and data reporting. The specifications outline contractor QC responsibilities and the requirements of the Chemical Data Acquisition Plan for construction. Appropriate chemical concerns should be addressed at each design submittal phase.
5. **Chemical Quality Assurance (QA)** - The government activities required to assure desired and verifiable levels of quality in chemical data for a specific project. Chemical Quality Assurance activities are defined in Appendix E.

6. Chemical Quality Assurance Report (CQAR) - Prepared by the designated QA laboratory; approved by the investigation/design/construction division; and normally ready for distribution within 30 days of receipt of the AE/contractor analytical data. The report will include an overall evaluation of the contractor's/AE's data and quality assurance data, a comparison of the contractor's and government results, problems in accomplishing the CDAP, and lessons learned. The CQAR shall be prepared in accordance with the guidance found in Appendix E.

7. Chemical Quality Control (QC) - Specific activities for insuring that data of the required quality will be obtained for a specific project by the AE, construction contractor, or government (for in-house chemical analyses). Normally this consists of the analysis of field blanks, duplicate samples and the inclusion of laboratory internal quality control procedures as required by the methods or otherwise specified.

8. Construction District - The district assigned the responsibility to administer the construction contract.

9. Construction Division - The geographic USACE division in which the Construction District is located.

10. Contract Laboratory - The laboratory retained by a USACE AE/contractor or QA laboratory to perform chemical analyses of field samples. These laboratories are evaluated in accordance with the procedures in Appendix C, and must be validated by CEMRD prior to performing chemical analyses for HTW projects.

11. Daily Quality Control Report (DQCR) - A daily report prepared by an AE in accordance with the Scope of Services or by a construction contractor per contract specifications and submitted to the Contracting Officer (CO) during chemical contamination investigation and remedial activities. Copies are sent by the COR to the QA laboratory whenever sampling and analytical activities are involved. The DQCR shall contain at a minimum the following with respect to chemistry:

(a) Work performed. Sections in the CDAP that specify the sampling procedure and the analytical procedure shall be referenced. Weather information at the time of sampling shall be included. Information concerning all field samples, sample shipping, and field instrument measurements and calibration shall be included.

(b) Departures from the approved sampling plan. Include problems identified, corrective actions, and verbal/written instructions from USACE personnel. These shall be reported to the contracting officer (CO) in writing within two working days.

12. Data Quality Objectives (DQO) - DQOs are qualitative and quantitative statements specifying the level and extent of chemical data required to support decisions during remedial activities. They are determined based on the end uses of the data to be collected. DQOs are established prior to data collection and are not considered a separate deliverable. Rather, the DQO development process is integrated with the project planning process and the results are incorporated into Scopes of Work and Work Plans for the site. The levels and responsibility for data validations should be determined with the DQOs.

13. Design Analysis Reports - Documents prepared during design to support the Plans and Specifications. Technical Design Analysis Reports should have a section or chapter dedicated to design chemical evaluations and to the level of sampling, analysis, and CDQM required to support and document construction.

14. Design District - The USACE district assigned the responsibility for coordinating, reviewing, and completing design documents, including plans and specifications for HTW site design activities either in-house or through contracted services. Other Design District responsibilities include procuring AE services and construction contracts when work is not done in-house.

15. Design Division - The USACE Division overseeing the Design District.

16. HQUSACE (CEMP-R) - Headquarters office responsible for CDQM requirements and other supporting issues related to the proper implementation and execution of all phases of HTW program activities under USACE management.

17. Internal Quality Control - Measures which a laboratory implements to ensure data reliability. These include the analysis of blanks of various types, replicate sample or extract analysis, lab duplicates, blind standards, matrix spikes, matrix spike duplicates, surrogate compound analysis, calibrations, generation of control charts, etc. Minimal requirements are



usually specified in the analytical methods. Internal quality control needs and requirements should be determined as a part of the Data Quality Objectives. All internal quality control results should be reported with the sample results.

18. Investigation District - The USACE district assigned the responsibility for coordinating, reviewing, and completing an HTW site investigation activity either in-house or through contracted services.

19. Investigation Division - The USACE Division overseeing the Investigation District.

20. Laboratory Validation - An ongoing assessment of laboratory capabilities, including evaluation of personnel, equipment, QA/QC procedures, results from performance evaluation samples and an on-site laboratory inspection.

21. Matrix is the environmental medium which is sampled; e.g. groundwater, surface water, soil, sediment, waste, etc.

22. Quality Assurance - Measures taken by USACE to oversee the work of contractors.

23. QA Laboratory - The validated USACE Division Laboratory performing or coordinating CDQM activities for a project. These activities ordinarily include: document review, inspection and analysis of quality assurance samples, technical assistance to project managers and preparation of the Chemical Quality Assurance Reports. A given Division Laboratory may not have capability for in house performance of all these activities. The QA laboratory is assigned on a project specific basis by CEMRD. QA functions may not be contracted out directly by the FOA to commercial enterprises. QA sample analysis may be performed under contract to the USACE QA laboratory.

24. Quality Assurance and Quality Control Samples. Samples analyzed for the purpose of assessing the quality of the sampling effort and of the analytical data. QA and QC samples include splits or replicates of field samples, rinsate blanks, trip blanks, and background (up gradient) samples. The purpose of the sample is to provide site specific field originated checks that the data generated by the contractor's analytical lab are of suitable quality.

25. Quality Control - Measures taken by contractors and to verify the reliability of their own work and to oversee subcontractors.

26. Quality Control Summary Report (QCSR) - A report submitted by the AE/construction contractor at the conclusion of a chemical contamination remedial activity. For an investigation activity, the QCSR may be included in the Investigation Report. The QCSR should include the following.

(a) An outline of QC practices employed by the AE/construction contractor, including any problems and corrective actions taken;

(b) A consolidation and summary of the DQCR, as prescribed in the contract.

27. Replicate (duplicate, triplicate, etc.) Samples. Multiple grab samples, collected separately, that equally represent a medium at a given time and location. This is the required type of collocated sample for volatile organic analyses and most groundwater and surface water samples.

28. Rinsate blanks (equipment blanks) are field blanks generated by passing analyte-free reagent water through sampling equipment after it has been decontaminated between uses. Rinsates are analyzed by the same methods as the samples for which they are blanks and are a check on sampling and decontamination procedures.

29. Split is a field sample taken, homogenized, divided in the field, contained and sent to one or more laboratories for analysis.

30. Trip Blank. 40 mL vials of organic-free reagent water that are kept with the field sample containers from the time they leave the laboratory until the time they are returned to the laboratory. The purpose of trip blanks is to determine whether samples are being contaminated during transit or sample collection. Trip blanks pertain only to volatile organic analyses; therefore, the containers must contain no headspace. Only one trip blank is needed for one day's sampling and shall satisfy trip blank requirements for all matrices for that day if the volatile samples are shipped in the same cooler.

31. Scope of Services - Prepared by a District or Field Operation Activity (FOA) and provided to a contractor for the purposes of work definition and fee negotiation. The Scope of Services for an investigation activity shall have attached guidance to the AE including Guide for Preparing a Chemical Data Acquisition Plan (CDAP) (Appendix D), and the Sample Handling Protocol (Appendix F). The Scope of Services for design shall provide the AE with guidance including any appropriate Guide Specifications for Chemical Data Quality Management and the Sample Handling Protocol (Appendix F).

32. Site Inspection Report or Investigation Report - Prepared by the AE firm or the investigating district (in-house work) and includes a summary of work done, departures from the CDAP, analytical results, results from all testing, field observations, and regulatory or action level factors which impact on decisions to be made as a result of the investigation.

**APPENDIX C**  
**HEALTH AND SAFETY PLAN (HASP)**  
**(RUST Engineering)**



**HEALTH AND SAFETY PLAN  
ADDENDUM NO. 1**

**HIMCO DUMP  
REMEDIAL INVESTIGATION/FEASIBILITY STUDY  
ELKHART, INDIANA  
JUNE 1995  
Prepared for:**

**Department of the Army  
Corps of Engineers, Omaha District  
215 North 17th Street  
Omaha, Nebraska 68102-4978**

**HEALTH AND SAFETY PLAN FOR  
REMEDIAL INVESTIGATION/FEASIBILITY STUDY  
HIMCO DUMP**

**ADDENDUM NO. 1  
JUNE 1995**

Prepared by:

*Lynn McIntosh*

Lynn M. McIntosh  
Project Manager  
Rust Environment & Infrastructure

Approved by:

*Richard Tinsley*

Richard Tinsley, CIH  
Regional Health & Safety Specialist  
Rust Environment & Infrastructure

## 1.0 INTRODUCTION

A Final Health and Safety Plan (HASP) was prepared in July 1990 in accordance with the ARCS V Program Health and Safety Guidelines HAS-1 and the regulatory requirements of 29 CFR 1910.12, "Hazardous Waste Operations and Emergency Response." This Addendum has been established as Addendum No. 1 of the Remedial Investigation/Feasibility Study for the Himco Dump Site located in Elkhart, Indiana. The original HASP (July 1990) and this Addendum will be implemented by the Health and Safety Officer (HSO).

Compliance with this HASP Addendum No. 1 and the original HASP is required of all personnel who enter this site.

The content of the HASP Addendum No. 1 and the original HASP may change or undergo revision based upon additional information made available to health and safety personnel, or monitoring results or changes in the technical scope.

### Scope of Work:

1. Soil borings/monitoring well installation.
2. Monitoring well development, sample collection activities.
3. Soil gas sampling.

### SITE MANAGER

Name: Joe Morrissey  
Work Phone: 402-221-3108  
Home Phone: 402-556-3809

### HEALTH AND SAFETY OFFICERS

Name: Michelle Benak  
Work Phone: 402-221-7161  
Home Phone: 402-551-5462



## **8.0 PERSONNEL PROTECTIVE EQUIPMENT**

The Level D personal protective clothing and equipment is modified from the Final Health and Safety Plan dated July 1990 to include the following:

Level D personal protective clothing and equipment includes:

- Polycoated tyvek or tyvek coveralls - required in sampling areas when splashing by contaminated soils or water is a possibility.
- Hardhat (when overhead hazards exist).
- Safety glasses or goggles.
- Steel toe, steel shank boots.
- Disposable latex gloves - required when handling and collecting soil and water samples.
- Outer nitrile gloves - required when handling and collecting soil and water samples.
- Disposable outer boots or rubber outer boots which and be decontaminated - required when walking in areas of contaminated soils.

## 9.0 AIR MONITORING

Section 9.2 has been modified to the following. No other changes have been made to this section from the Final Health and Safety Plan dated July 1990 were made.

Instrument	Action Levels	Level of Respiratory Protection/Action
HNu/OVA	Continuous readings of 0.0 to 1.0 ppm above background in BZ	Level D
HNu/OVA	Continuous readings of 1.0 to 5.0 ppm above background in BZ	Evacuate and Assess upgrade to Level C
HNu/OVA	Continuous readings of 5 to 500 ppm above background in BZ	Evacuate and upgrade to Level B
HNu/OVA	Continuous readings >500 ppm above background in BZ	Evacuate and call CHSS and HSM
Lumidor (CGI)	<19.5% oxygen	Level B
Lumidor (CGI)	>10ppm H <sub>2</sub> S	Evacuate and upgrade to Level B
Lumidor (CGI)	>10%LEL in borehole	Proceed with caution
Lumidor (CGI)	>20% LEL in borehole again.	Evacuate, vent, and begin work after levels are safe
Geiger Counter	>0.01 mrem/hr in the borehole or physicist.	Evacuate area and call any site area health

## **14.0 AUTHORIZATIONS AND FIELD TEAM REVIEW**

### **14.1 AUTHORIZED PERSONNEL**

Personnel authorized to enter the Himco Dump Site while field investigations are being conducted must be certified by the HSO. Authorization will involve completion of appropriate training courses and medical examination requirements as required by OSHA 29 CFR 1910.120, and review and sign-off of this HASP. All personnel must utilize the buddy system or be escorted by appropriately trained personnel, and check in with the Field Team Leader at the site office.

#### **A. USACE Personnel Authorized to Perform Work On-Site:**

1. Rick Grabowski
2. Joe Morrissey
3. Michelle Benak
4. Tim Jensen

#### **B. Other Personnel Authorized to Enter Site:**

1. USEPA-RPM
2. Subcontractor Personnel